PRN 50-M (M-Port) and PRN 50 (AutoPort) Digital Writer

Service Manual

2006503-001 Revision A

GE Medical Systems
Information Technologies

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1 Introduction

For your notes

Manual Information

Revision History

Each page of this manual has a revision letter located at the bottom of the page. It identifies the revision level of the entire manual. This may be important if you have more than one manual and you wish to know which is the most current.

For the initial release, all pages have the revision letter A. For the second update, all pages receive the revision letter B. The latest letter of the alphabet added to the table below corresponds to the most current revision.

Table 1. Revision History

Revision	Date	Comment
A	3/23/2001	Initial Release

Purpose of Manual

This Service Manual covers the use of both:

- The PRN 50 writer with the M-Port interface (PRN 50-M) and
- The PRN 50 writer with the AutoPort interface (PRN 50).

This manual provides technical information for service representatives and technical personnel involved in configuring and maintaining the PRN 50-M and the PRN 50 Digital Writers.

Safety Information

Responsibility of the Manufacturer

GE Medical Systems *Information Technologies* is responsible for the effects of safety, reliability, and performance only if:

- assembly operations, extensions, readjustments, modifications, or repairs are carried out by persons authorized by GE Medical Systems *Information Technologies*;
- the electrical installation of the relevant room complies with the requirements of the appropriate regulations; and
- the device is used in accordance with the instructions for use.

Intended Use

Follow the directives stated below when using the PRN 50-M Digital Writer.

- This device is intended for use under the direct supervision of a licensed health care practitioner.
- This device is not intended for home use.
- Federal law restricts this device to be sold by or on the order of a physician.
- Contact GE Medical Systems *Information Technologies* for information before connecting any device to the equipment that is not recommended in this manual.
- Parts and accessories used must meet the requirements of the applicable IEC 601 series safety standards, and/or the system configuration must meet the requirements of the IEC 60601-1-1 medical electrical systems standard.
- Periodically, and whenever the integrity of the device is in doubt, test all functions.
- The use of ACCESSORY equipment not complying with the equivalent safety requirements of this equipment may lead to a reduced level of safety of the resulting system. Consideration relating to the choice shall include:
  - use of the accessory in the PATIENT VICINITY; and
  - evidence that the safety certification of the ACCESSORY has been performed in accordance to the appropriate IEC 60601-1 and/or IEC 60601-1-1 harmonized national standard.
- If the installation of the equipment, in the USA, will use 240V rather than 120V, the source must be a center-tapped, 240V, single-phase circuit.

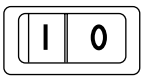
Equipment Symbols

The following symbols appear on the transmitter.

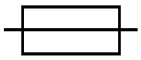
ATTENTION: Consult accompanying documents before using the equipment.

Equipotentiality

Alternating current (AC)



Power switch; I = ON; O = OFF.



Fuse

Warnings, Cautions, and Notes

Warnings and Cautions are used throughout this manual to designate a degree or level of hazardous situations. Hazard is defined as a source of potential injury to a person.

WARNING
A warning indicates a potential hazard or unsafe practice which, if not avoided, could result in death or serious injury.

CAUTION
A caution indicates a potential hazard or unsafe practice which, if not avoided, could result in minor personal injury or product/property damage.

NOTE
A note provides application tips or other useful information to assure that you get the most from your equipment.

Service Information

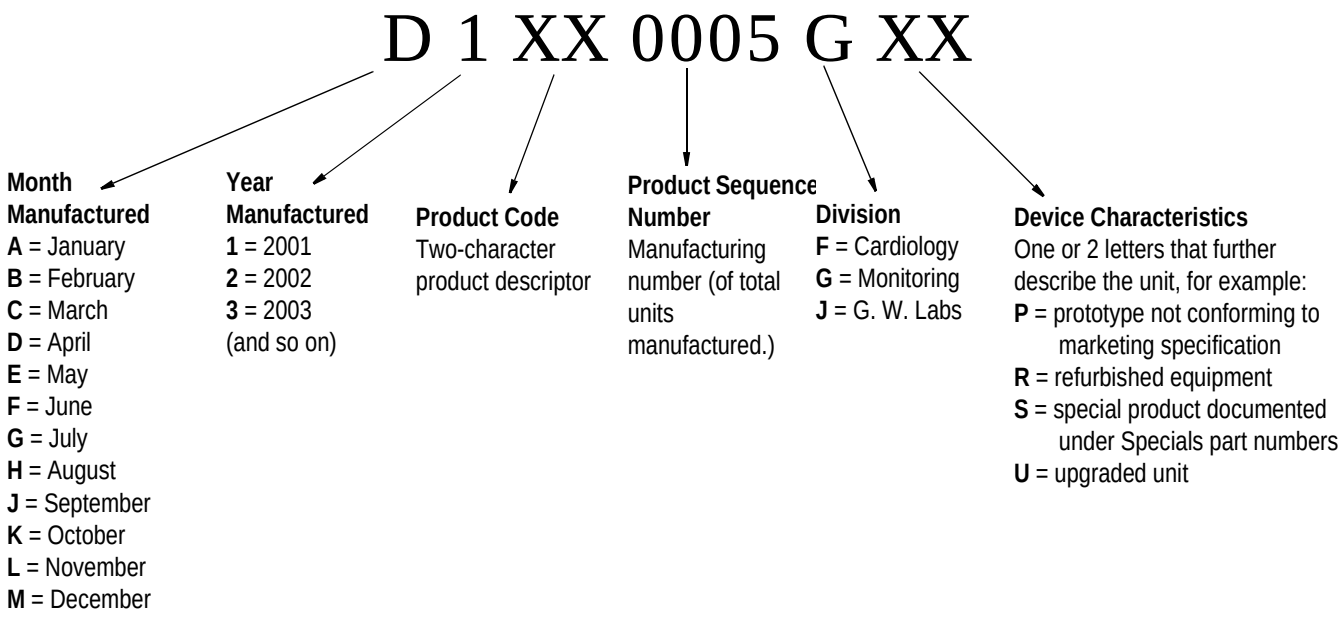
Service Requirements

Follow the service requirements listed below.

- Refer equipment servicing to *Information Technologies*' authorized service personnel only.
- Any unauthorized attempt to repair equipment under warranty voids that warranty.
- It is the user's responsibility to report the need for service to GE Medical Systems *Information Technologies* or to one of their authorized agents.
- Failure on the part of the responsible individual, hospital, or institution using this equipment to implement a satisfactory maintenance schedule may cause undue equipment failure and possible health hazards.
- Regular maintenance, irrespective of usage, is essential to ensure that the equipment will always be functional when required.

Equipment Identification

Every GE Medical Systems *Information Technologies* device has a unique serial number for identification. The serial number appears on the product label for each unit.



Warranty

1 year.

2 Equipment Overview

For your notes

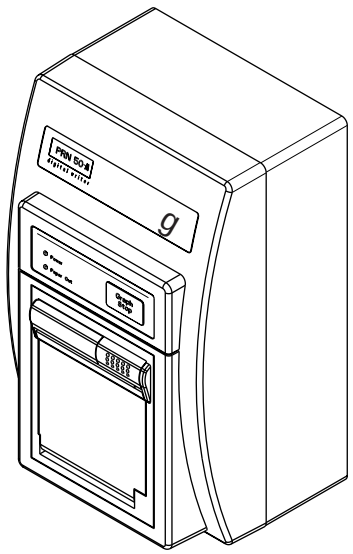
Description of Equipment

PRN 50-M and PRN 50 Digital Writers

The PRN 50-M and PRN 50 Digital Writers thermally record patient data on a paper strip. You can graph any parameter or trace you monitor on a Solar 7000/8000/8000M monitor, Eagle 4000 monitor, Centralscope, or CIC system on the the writer. Graphs are initiated automatically when an alarm activates, or you can manually initiate a graph from a monitor.

The writer provides a high-resolution recording of patient waveform data, including alphanumeric text relating to the waveform data. A microprocessor-driven thermal print head translates digitized data directly into graphic forms on the strip chart. Up to four real-time waveforms from the monitor screen may be graphed simultaneously. The writer also generates printouts of stored information, including trended parameters, arrhythmia information, and cardiac calculations, pulmonary calculations, and dose calculations.

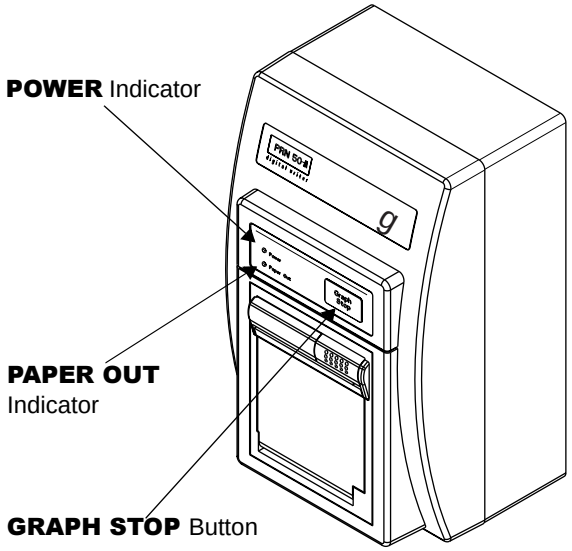
The paper drive motor is the only moving part on the PRN 50-M. This motor operates at eight different speeds—0.1, 0.5, 1, 5, 10, 12.5, 25, and 50 mm/s.



PRN 50-M and PRN 50 Digital Writer

Controls

A **POWER** indicator illuminates when power is applied and a **PAPER OUT** indicator illuminates when you need to add paper or the paper carriage door is open. If you press the **GRAPH STOP** switch while graphing, the writer stops immediately. If you hold the switch down for more than 10 seconds, an alphanumeric test strip prints out.



Front Panel Controls

Interconnection

M-Port/AutoPort Compatibility

1. An M-Port Host/Device must be connected to an M-port Device/Host.
2. If an AutoPort Host/Device is to be connected to an M-Port Device/ Host, the AutoPort Host/Device must be adapted to an M-Port pin out by using the AutoPort to M-Port Adapter.

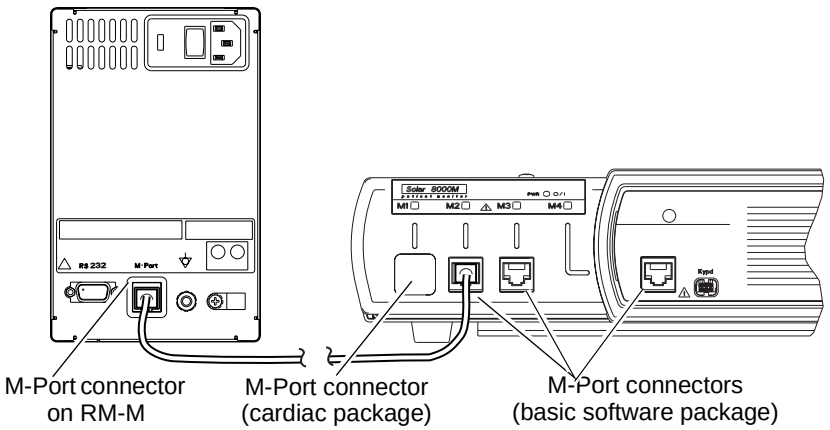
NOTE

Whether a host or device implements an M-Port or an AutoPort interface can be determined by:

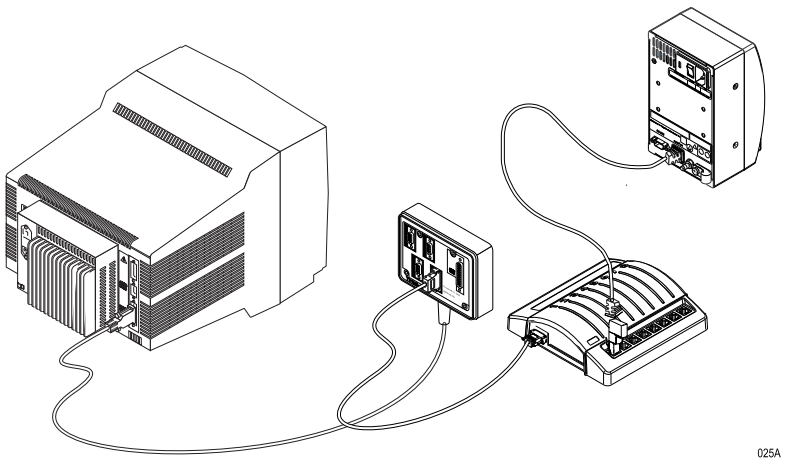
1. M-Port Host/Device products have any or all of the following:
   a. Have the word 'M-Port' or 'M#' e.g., 'M1', 'M2', 'M3'; for the connector name on the label above the RJ-45.
   b. Have the text for the name of the RJ-45 connector in a yellow field.
   c. Have a product name that ends in an 'M', e.g., Solar 8000M, PRN 50-M, Respiratory Mechanics-M.
2. AutoPort Host/Device products do not have any of the above.

Device Connections

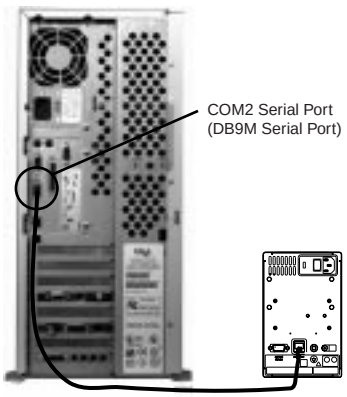
Below are figures of device connections using the Octanet connectivity device and using the Tram-net Interface Adapter. Refer to "Connection of a PRN 50-M/PRN 50 to a:" on page 2-7 for connection instructions.



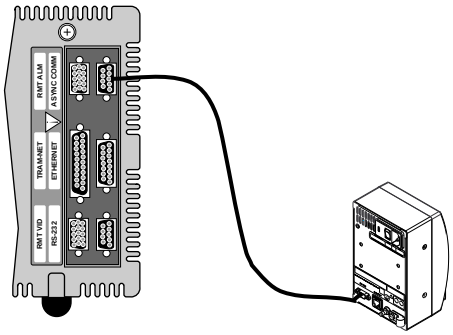
8000M M-Ports



RM-M Module Connected to Patient Monitor via Octanet Connectivity Device with M-Port to AutoPort Adapter



CIC to PRN 50-M



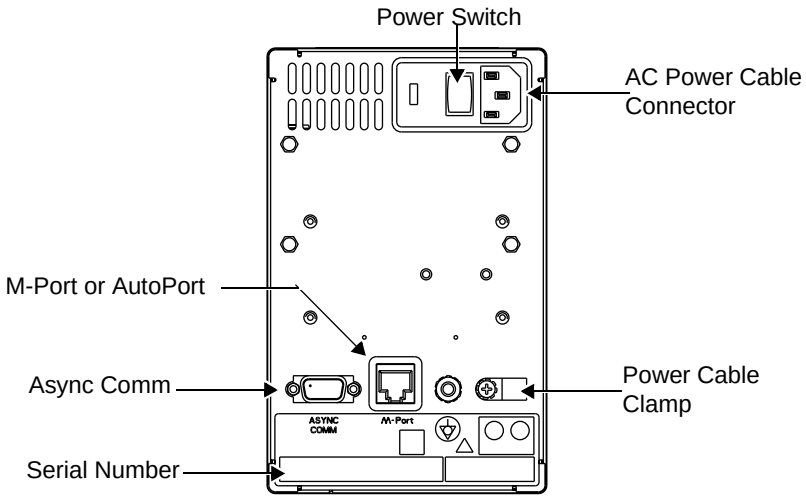
Solar 8000 to PRN 50-M ASYNC Port

Table 2. Host to PRN 50-M/PRN 50 Connections.

Hosting Device		PRN 50-M/PRN 50			Interconnection Between Host and Writer			
Monitor/Octanet/ Central Station	Connector Used	Type	Connector Used	Protocol (Note #1)	Adapter			Cable Used
					Needed?	Part #	Where Placed	
Solar 8000M	RJ-45 M1.. M4 (M-Ports)	PRN 50-M	RJ-45	M-Port	No			418335-00*x*
		PRN 50	RJ-45	AutoPort	Yes	2001973-001	PRN 50	418335-00*x*
Octanet	RJ-45 (AutoPorts)	PRN 50-M	RJ-45	M-Port	Yes	2001973-001	Octanet	418335-00*x*
		PRN 50	RJ-45	AutoPort	No			418335-00*x*
CIC	DB9M Serial Port	PRN 50-M	RJ-45	M-Port	Yes	2006550-001	CIC	418335-00*x*
		PRN 50	RJ-45	AutoPort	No			422843-00*x*
Eagle 3000 Eagle 4000 Solar 7000 Solar 8000 Tramscope Centralscope	DB9F Async	Either PRN 50-M or PRN 50	DB9M	Async	No			700179-00*x*

NOTE

The RJ-45 connector protocol is specified on the label below the RJ-45 Connector (i.e, **M-Port** or **AutoPort**).



Back Panel

Table 3. Adapter/Cable References for Table 4	
Cable or Adapter	**Part Number**
AutoPort to M-Port Adapter	GEMS-IT #2001973-001
RJ-45 Cable	GEMS-IT #418335-00*x*
CIC(DB9F) to PRN 50-M (RJ-45) Adapter	GEMS-IT #2006550-001
Female DB9 TO Male RJ45 Cable	GEMS-IT #422843-00*x*
Scope DB9M/DB9F Cable	GEMS-IT #700179-00*x*

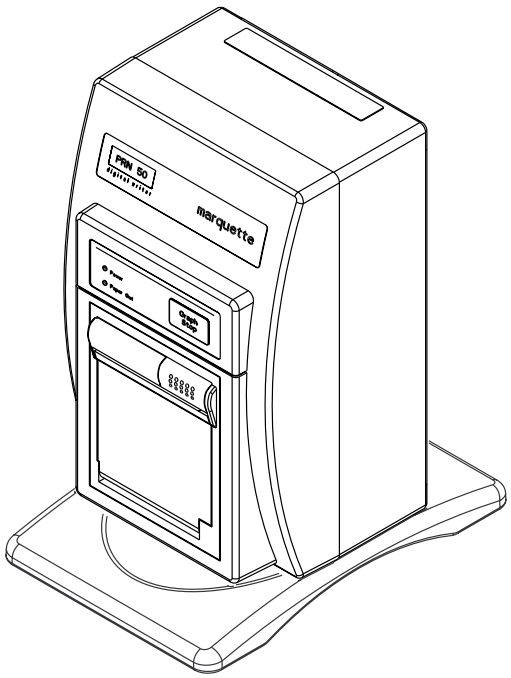
Table 4. Connection of a PRN 50-M/PRN 50 to a:	
Monitor/Host:	**Instructions:**
Solar 8000M:	
With the PRN 50-M writer (which has the M-Port interface):	1. Connect one end of an RJ-45 cable into the RJ-45 connector on the PRN 50-M labeled 'M-Port'. 2. Connect the other end of the cable into any available M-Port RJ-45 connectors on the front of the Solar 8000M labeled 'M1,' 'M2,' 'M3,' or 'M4.' 3. Make sure that all components have power on. 4. Make selections desired using the Graph menu options.
With the PRN 50 writer (which has the AutoPort interface):	1. Place an AutoPort to M-Port Adapter into the RJ-45 connector on the PRN 50 labeled 'AutoPort'. 2. Connect one end of an RJ-45 cable into the RJ-45 connector in the AutoPort to M-Port Adapter which was inserted into the PRN 50 connector labeled 'AutoPort' in step #1. 3. Connect the other end of the cable into any available RJ-45 connectors, M-Ports on the front of the Solar 8000M labeled 'M1', 'M2', 'M3' or 'M4'. 4. Make sure that all components have power on. 5. Make selections desired using the Graph menu options.
Octanet Connectivity Device:	
With the PRN 50-M writer (which has the M-Port interface):	1. Place an AutoPort to M-Port Adapter into one of the RJ-45 connectors (AutoPorts) on the front of the Octanet. Connectivity Device. 2. Connect one end of an RJ-45 cable into the RJ-45 connector on the PRN 50-M labeled 'M-Port'. 3. Connect the other end of the RJ-45 cable into the AutoPort to M-Port Adapter inserted into the Octanet Connectivity Device RJ-45 in Step #1 4. Make sure that all components have power on. 5. Make selections desired using the Graph menu options.
With the PRN 50 writer (which has the AutoPort interface):	1. Connect one end of the RJ-45 cable into the RJ-45 connector in the PRN 50 connector labeled 'AutoPort'. 2. Connect the other end of the RJ-45 cable into any available RJ-45 connectors (AutoPorts) on the front of the Octanet Connectivity Device. 3. Make sure that all components have power on. 4. Make selections desired using the Graph menu options.

Table 4. Connection of a PRN 50-M/PRN 50 to a:	
Monitor/Host:	**Instructions:**
CIC:	
With the PRN 50-M writer (which has the M-Port interface):	1. Place an CIC(DB9F) to PRN 50-M (RJ-45) Adapter on the DB9M serial port connector of the CIC. 2. Connect one end of an RJ-45 cable into the RJ-45 connector on the PRN 50-M labeled 'M-Port'. 3. Connect the other end of the RJ-45 cable into the RJ-45 connector in the adapter attached to the CIC in Step #1 4. Make sure that all components have power on. 5. Make selections desired using the Graph menu options.
With the PRN 50 writer (which has the AutoPort interface):	1. Connect the RJ-45 end of the FEMALE DB9 TO MALE RJ45 cable into the RJ-45 connector in the PRN 50 connector labeled 'AutoPort'. 2. Connect the other end of the FEMALE DB9 TO MALE RJ45 cable to the DB9M serial port connector of the CIC. 3. Make sure that all components have power on. 4. Make selections desired using the Graph menu options.
Eagle 3000, Eagle 4000, Solar 7000, Solar 8000, Tramscope, Centralscope:	
With the PRN 50-M (which has the M-Port interface) or the PRN 50 writer (which has the AutoPort interface):	1. Connect the DB9F end of the Scope DB9M/DB9F cable into the DB9M connector in the PRN 50-M/PRN 50 connector labeled 'Async Comm'. 2. Connect the other end of the Scope DB9M/DB9F cable to the DB9F 'Async Comm' serial port connector of the Eagle 3000, Eagle 4000, Solar 7000, Solar 8000, Tramscope or Centralscope. 3. Make sure that all components have power on. 4. Make selections desired using the Graph menu options.

Mounting

You must use the PRN 50-M or PRN 50 with an optional pedestal base (shown below) or with an optional mounting bracket. See the GE Medical Systems *Information Technologies* Monitoring Systems Mounting Reference Guide (pn 403799-010) for detailed information.

CAUTION
Do NOT operate the device without an approved mount attached. The operational temperature of this device is maintained by air flow though the bottom vent holes.



PRN 50-M or PRN 50 with Pedestal

Technical Specifications

Table 5. Performance Specifications	
Display Indicators (LEDs)	Power, Paper Out
System Interface	May be used with any Solar monitor, Eagle monitor, or Tram display.
Number of Waveform Channels	Four maximum
Recorder Information	Automatic graphing from alarm or alarm stacking, manual graphing from monitor or central station display.
Writing Method	Thermal, fixed head, dot array.
Writing Resolution	200 dots/inch vertical, 480 dots/inch horizontal at 25 mm/s.
Paper Width	50 mm (1.97 in)
Paper Length	30.5 m (100 ft.)
Paper Speed	0.1, 0.5, 1, 5, 10, 12.5, 25, 50 mm/s (±2%)
Waveform Frequency Response	Limited only by acquisition system.
Grid	Printed as needed.

Table 6. Environmental Specifications	
Power Requirements	110 ±20 VAC, 50/60 Hz, single phase 220 ±40 VAC, 50/60 Hz, single phase
Power Consumption	50 W maximum
Cooling	Convection
Heat Dissipation	170 Btu/hr
Operating	Ambient temperature: 0° C to 50° C (32° F to 122° F) Relative humidity: 5% to 95% (noncondensing).
Storage	Ambient temperature: –40° C to 70° C (–40° F to 158° F) Relative humidity: 5% to 95% (noncondensing).

Table 7. Physical Specifications	
Height	20.4 cm (8 in)
Width	11.6 cm (4.6 in)
Depth	9.3 cm (3.7 in)
Net Weight	2.6 kg (5.7 lb) with base 1.2 kg (2.7 lb) without base
Mounting	Free-standing when used with optional pedestal base. Optional wall mount also available.

Certification

Safety standards

UL Classified for 2601-1

UL Classified for CAN/CSA C22.2 No. 601.1

IEC 60601-1 Certified

CE Marking for the 93/42/EEC Medical Device Directive

Classifications

Equipment components are classified, according to IEC-60601-1, as:

Table 8. Product Classifications

	Type of protection against electrical shock	Degree of protection against electrical shock	Degree of protection against harmful ingress of water	Degree of safety of application in the presence of a flammable anesthetic mixture with air or with oxygen or nitrous oxide	Method(s) of sterilization or disinfection recommended by the manufacturer	Mode of operation
PRN 50-M	I	Not Marked	Ordinary	Not Suitable	NA	Continuous
PRN 50	I	Not Marked	Ordinary	Not Suitable	NA	Continuous

Key: **I**: Class I equipment

B: Type B equipment

BF: Type BF equipment

CF: Type CF equipment

NA: Not applicable

Ordinary: Ordinary equipment (enclosed equipment without protection against ingress of water)

Not Suitable: Equipment not suitable for use in the presence of a flammable anesthetic mixture with air or with oxygen or nitrous oxide

Underwriters Laboratories, Inc.

Classified by Underwriters Laboratories Inc. with respect to electric shock, fire, mechanical and other specified hazards, only in accordance with UL 2601-1, CAN/CSA C22.2 No. 601.1, IEC 60601-1, and, if required, IEC 60601-2-27, IEC 60601-2-30, IEC 60601-2-34, IEC 60601-1-1.

For your notes

3 Troubleshooting

For your notes

General

Troubleshooting the Components

This section contains information that may be useful when you troubleshoot the PRN 50-M and PRN 50 Digital Writers.

Visual Inspection

This visual inspection procedure looks for obvious problems in the equipment. Simple failures–disconnected cables, foreign debris on a printed circuit board, or even missing hardware–can seriously affect the operation.

These simple failures can appear to be completely different problems to the user, or repair technician, making the troubleshooting process very difficult.

The following steps might seem trivial but we highly recommended that you perform them to remove these “simple” failures as causes of problems in the equipment.

- Never turn off host equipment by pulling the power cord out of the wall receptacle. Always use the power switch to apply/remove power. Always verify that the power switch is in the **OFF** position before removing the power cord from the wall receptacle. Set the power switch to the **OFF** position and disconnect the equipment from its power source.
- Check all power and interface cables to make sure they are firmly connected. There should be no excessive tension on any of the cables nor should any of them be showing any signs of excessive wear.
- Check rear connector of the module for foreign debris or crushed connections.
- Check the power cord on the host equipment. Verify that the line, neutral and ground wires are all connected firmly to the plug and that they are not shorted together. See wall receptacle check found in Electrical Safety Tests of the appropriate patient monitor service manual.

Controlling Electrostatic Discharge Damage

All external connector inputs and outputs of the device are designed with protection from ESD damage. However, if the device requires service, exposed components and assemblies contained within are susceptible to ESD damage. This includes human hands, non-ESD protected work stations and/or improperly grounded test equipment.

The following guidelines will help make a service workstation more resistant to the ESD damage:

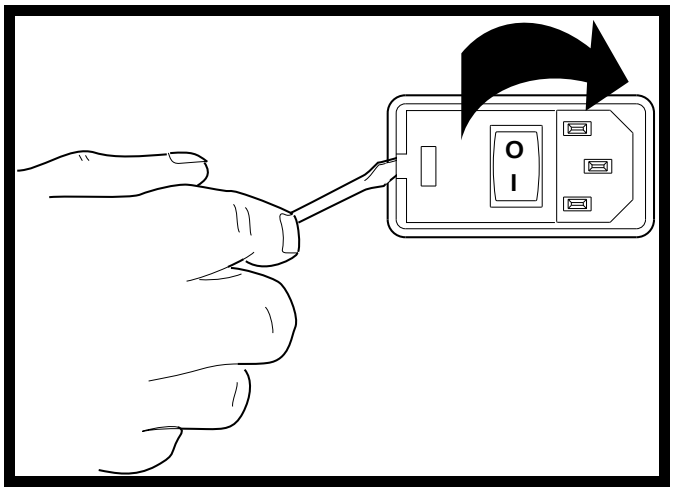
- Discharge any static charge you may have built up before handling semiconductors or assemblies containing semiconductors.
- A grounded, antistatic wristband (3M part number 2046 or equivalent) or heel strap should be worn at all times while handling or repairing assemblies containing semiconductors.
- Use properly grounded soldering and test equipment.
- Use a static-free work surface (3M part number 8210 or equivalent) while handling or working on assemblies containing semiconductors.
- Do not remove semiconductors or assemblies containing semiconductors from antistatic containers (Velo-stat bags) until absolutely necessary.
- Make sure power to an assembly is turned off before removing or inserting a semiconductor.
- Do not slide semiconductors or electrical/electronic assemblies across any surface.
- Do not touch semiconductor leads unless absolutely necessary.
- Semiconductors and electrical/electronic assemblies should be stored only in antistatic bags or boxes.

These guidelines may not guaranty a 100% static-free workstation, but will greatly reduce the potential for failure of any electrical/electronic assemblies.

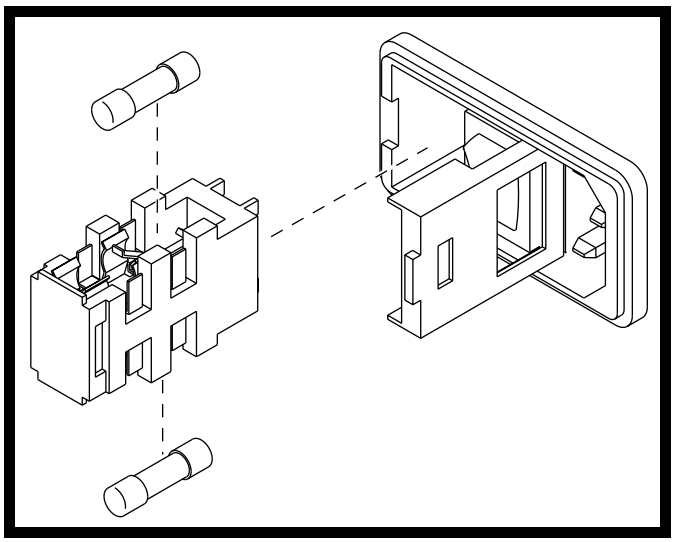
Fuse Replacement

The fuse drawer on the PRN 50-M contains two metric fuses (pn 409801-003). Follow these steps to replace the fuses.

1. Place the power switch on the power-entry module in the **OFF** position.
2. Remove the power cord from the mains power source and the power-entry module.
3. Use a small screwdriver to release the power-entry module door and loosen the fuse holder block from the power-entry module.



4. Remove the fuse holder block, replace the defective fuse(s) and reassemble.



Thermal Writer Replacement Procedure

This procedure details the removal and replacement of the thermal writer assembly in the PRN 50-M and PRN 50.

NOTE

To control static-discharge damage, be sure to discharge any static charge you may have built up before starting this procedure. Wear a grounded, antistatic strap and use grounded test equipment.

This procedure should be performed in the order listed.

1. Turn the **ON/OFF** switch at back to **OFF** position. Always use the **ON/OFF** switch to apply power. Remove power cord from unit.
2. Disconnect the PRN 50-M or PRN 50 from the patient monitor and communication network, if applicable.

Disassembly

To remove the thermal writer assembly, refer to "Writer Replacement Illustrations" on page 3-8 and do the following.

1. Open the writer door and locate the two Phillips screws inside, at the back of the paper roll compartment.
2. Fully loosen the two captive screws and separate the two halves of the PRN 50-M or PRN 50 assembly. (The two screws remain in the assembly.)

CAUTIONS

To avoid doing possible damage to the thermal print head, access the screws through the two slots in the paper carriage door.

Always hold the writer and bezel together to avoid putting strain on the flex cable and front panel membrane.

3. Lift up on the flex cable connector latch and disconnect the flex cable from the back of the writer.
4. Pull the writer straight forward from the front bezel.
5. Return removed 2-inch thermal writer to GE Medical Systems *Information Technologies*.

Reassembly

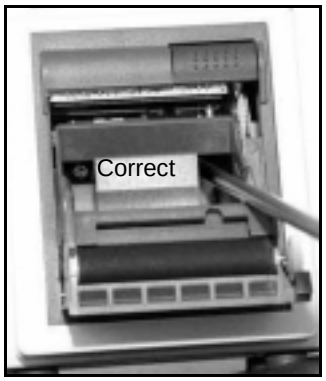
To replace the thermal writer assembly, refer to "Writer Replacement Illustrations" on page 3-8 and do the following.

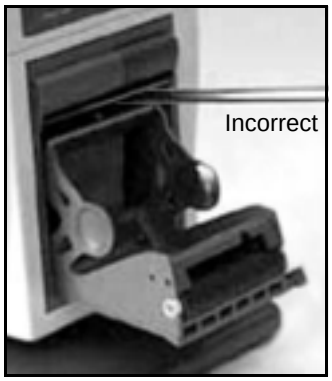
1. Slide the new thermal writer straight into the front bezel.
2. Feed the flex cable through the opening in the PCB and press the release latch on the flex connector to lock the cable in place.
3. Slightly tug on the flex cable to confirm that the connector has latched.
4. Carefully slide the two halves of the PRN 50-M or PRN 50 back together, open the paper carriage door and tighten the two screws.

CAUTION
Do NOT overtighten the screws. Overtightening the screws could cause damage to the PRN 50-M or PRN 50.

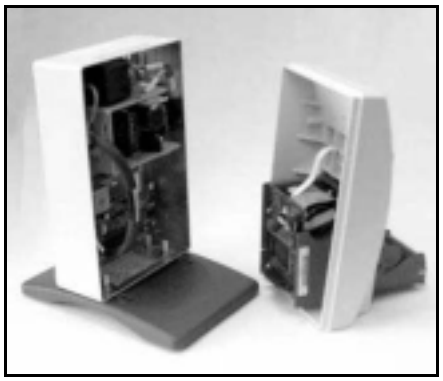
Writer Replacement Illustrations

Loosen the Screws

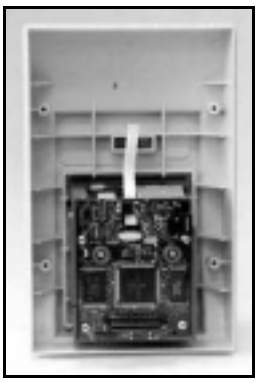




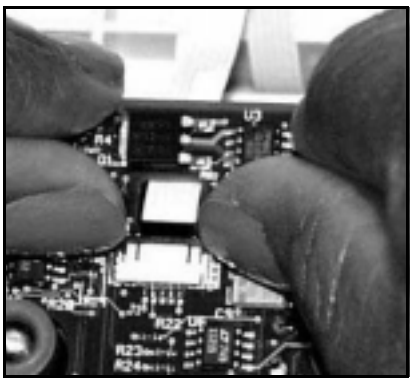
Separate the Assembly



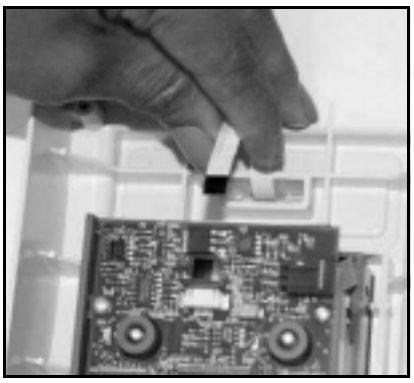
Inside Front Bezel



Unlock the Flex Cable

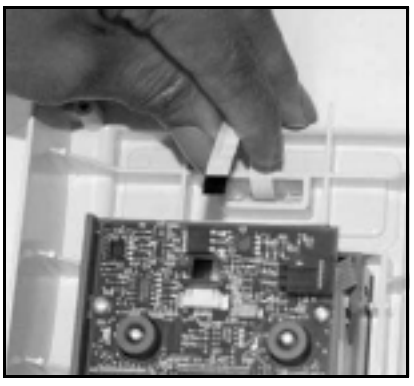


Remove the Flex Cable

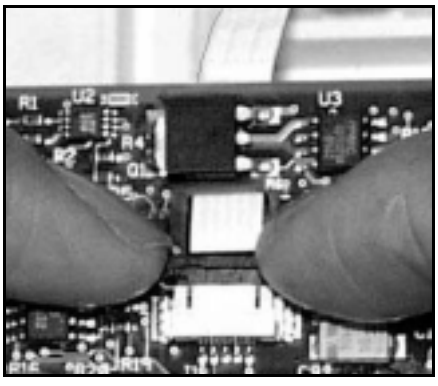


Remove & Replace the Writer

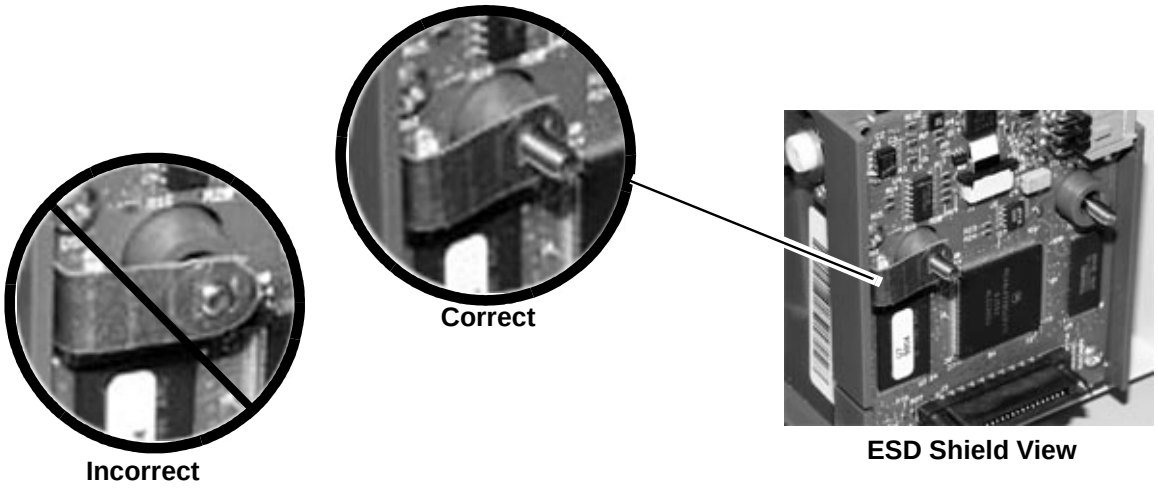
Reattch the Flex Cable



Lock the Flex Cable



5. Thread the mounting screw completely through the ESD shield as shown below before sliding the two halves of the PRN 50-M or PRN 50 back together.



6. Carefully slide the two halves of the PRN 50-M or PRN 50 back together, open the paper carriage door and tighten the two mounting screws

Completion

1. Reattach the power cord to the unit.
2. To verify the operation of the PRN 50-M or PRN 50, complete the "System Performance Test" on page 4-9.
3. Because the thermal writer was replaced, perform the "Ground (Earth) Wire Leakage Current Tests" on page 4-14 and the "Enclosure Leakage Current Test" on page 4-15.

Power Supply Replacement Procedure

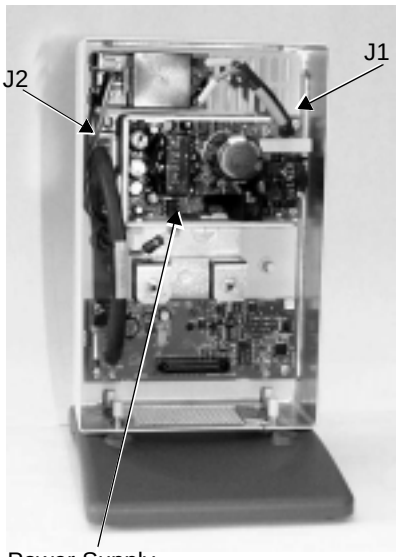
This procedure details the removal and replacement of the power supply assembly in the PRN 50-M and PRN 50.

CAUTION
To control static-discharge damage, be sure to discharge any static charge you may have built up before starting procedure. Wear a grounded, antistatic strap and use grounded test equipment.

This procedure should be performed in the order listed.

1. Turn the ON/OFF (**I/O**) switch OFF (**O**). Always use the ON/OFF (**I/O**) switch to apply power. Remove the power cord from the unit.
2. Disconnect the PRN 50-M or PRN 50 from the patient monitor and communication network, if applicable.

Disassembly



To gain access to the power supply assembly, refer to the illustrations on the previous page and do the following:

1. Open the writer door and locate the two Phillips screws inside, at the back of the paper roll compartment.
2. Fully loosen the two captive screws, separate the two halves of the PRN 50-M or PRN 50 assembly, and carefully set the writer and front bezel assembly aside. (The two screws are retained in the assembly.)

CAUTIONS

To avoid doing possible damage to the thermal print head, access the screws through the two slots in the paper carriage door.

Always hold the writer and bezel together to avoid putting strain on the flex cable and front panel membrane.

3. Disconnect the cables at **J1** and **J2** on the power supply.
4. Remove the four mounting screws and remove power supply.
5. Install the new power supply and reverse the above procedure to reassemble the writer.

NOTE

The power supply is auto sensing and requires no adjustments.

6. Return removed power supply to GE Medical Systems *Information Technologies* Service.

Completion

1. Replace power cord to unit.
2. To verify the operation of the PRN 50-M or PRN 50, complete the "System Performance Test" on page 4-9.
3. Because the thermal writer was replaced, perform the "Ground (Earth) Wire Leakage Current Tests" on page 4-14 and the "Enclosure Leakage Current Test" on page 4-15.

Interface PCB Replacement Procedure

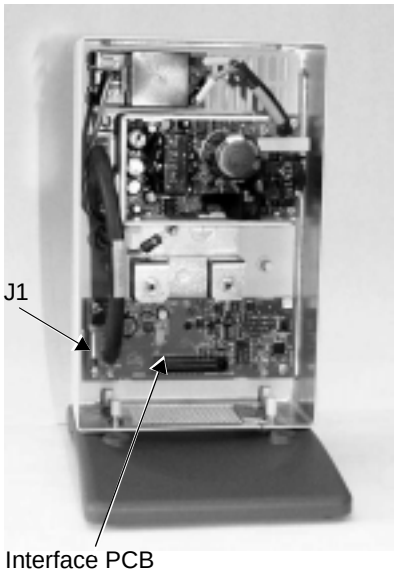
This procedure details the removal and replacement of the Interface PCB assembly in the PRN 50-M and PRN 50.

CAUTION
To control static-discharge damage, be sure to discharge any static charge you may have built up before starting procedure. Wear a grounded, antistatic strap and use grounded test equipment.

Perform this procedure in the order listed.

1. Turn the ON/OFF (**I/O**) switch at back OFF (**O**). Always use the ON/OFF switch to apply power. Remove the power cord from unit.
2. Disconnect the PRN 50-M or PRN 50 from the patient monitor and communication network, if applicable.

Disassembly



To gain access to the power supply assembly, refer to the illustrations on the previous page and do the following.

1. Open the writer door and locate the two Phillips screws inside, at back of paper roll compartment.
2. Fully loosen the two captive screws, separate the two halves of the PRN 50 assembly and carefully set the writer and front bezel assembly aside. (The two screws are retained in the assembly.)

CAUTIONS
To avoid doing possible damage to the thermal print head, access the screws through the two slots in the paper carriage door.

Always hold the writer and bezel together to avoid putting strain on the flex cable and front panel membrane.

3. Disconnect the cable at **J5** on the Interface PCB.
4. Remove the three mounting screws and remove the Interface PCB.
5. Remove the two jackscrews from the **Async Comm** connector on the back of the assembly.
6. Install the new Interface PCB and reverse the above procedure to reassemble the writer.

NOTE
The Interface PCB requires no adjustments.

7. Return the removed Interface PCB to *Information Technologies*.

Completion

1. Replace power cord to unit.
2. To verify the operation of the PRN 50-M or PRN 50, complete the "System Performance Test" on page 4-9.
3. Because the thermal writer was replaced, perform the "Ground (Earth) Wire Leakage Current Tests" on page 4-14 and the "Enclosure Leakage Current Test" on page 4-15.

4 Maintenance

For your notes

Maintenance Schedule

General

An effective maintenance schedule should be established for the PRN 50-M and PRN 50 Digital Writers. The schedule should include inspection, general cleaning, performance testing, and safety testing on a regular basis.

It is recommended that you perform the inspection, general cleaning, and cleaning of the print head every three months. It is recommended that you perform safety tests every twelve months or if any internal components have been altered.

For the purpose of record keeping, a "Preventive Maintenance Inspection" form is provided at the end of this chapter for duplication.

WARNING
A failure, on the part of the responsible individual hospital or institution employing the uses of this monitoring equipment, to implement a satisfactory maintenance schedule may cause undue equipment failure and possible health hazards.

Inspection

Inspect the PRN 50-M or PRN 50 on a regular basis. Follow these guideline when you inspect the equipment.

- Inspect the equipment for obvious physical damage and replace damaged items.
- Inspect all connectors for bent pins or prongs. Replace or repair any bad cables or connectors. Note that replacement of connectors should be performed only by qualified service personnel.
- Inspect all cable insulation. Qualified service personnel should repair or replace damaged or deteriorated cables.
- Inspect fuses.
- Inspect seating of socketed components and circuit boards.

General Cleaning

Exterior Cleaning

Clean the PRN 50-M or PRN 50 on a regular basis.

You may clean the exterior surfaces of the writer with a dampened lint-free cloth. Use one of the following approved solutions:

- ammonia (diluted),
- Cidex,
- sodium hypochlorite bleach (diluted), or
- mild soap (diluted).

To avoid damage to the equipment, follow these rules.

CAUTION
Failure to follow these rules may melt, distort, or dull the finish of the case, blur lettering on the labels, or cause equipment failures.

Always dilute the solutions according to the manufacturer's suggestions.

Always wipe off all the cleaning solutions with a dry cloth after cleaning.

Never use wax containing a cleaning substance.

Never pour water or any cleaning solution on the equipment or permit fluids to run behind switches, into the connectors, or into any ventilation openings in the equipment.

Never use these cleaning agents:

- abrasive cleaners or solvents of any kind,
- acetone,
- alcohol based cleaning agents (except for cleaning the thermal print head), or
- Betadine.

Interior Cleaning

On a regular basis, qualified service personnel should open the writer and blow dust from the unit with compressed air.

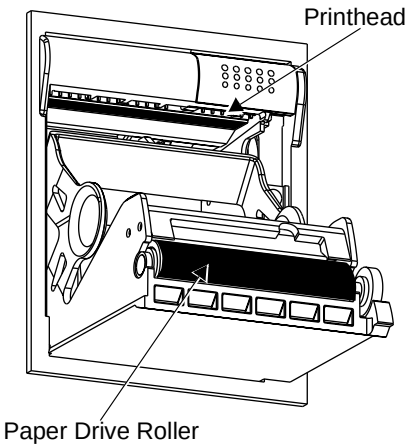
Cleaning the Print Head

This procedure explains how to clean the thermal print head. From heavy usage, debris accumulates on the thermal print head and distorts the printed image. It is recommended that you perform this procedure when necessary, depending on usage.

Materials Required

A nonabrasive material/cloth and isopropyl alcohol are all that are necessary to perform this procedure.

Procedure



Perform this procedure in the order listed.

1. Turn the **I/O** switch at the back of the unit to the **O** (off) position and disconnect the power cord from the mains source.
2. Open the writer door to expose the print head.
3. Remove paper roll.
4. Locate the print head (shown in the figure at the left). A flashlight may help illuminate the print head for closer examination.
5. Wipe the print head with alcohol and a nonabrasive material/cotton swab in a side to side motion. Continue wiping until the cloth/swab wipes clean.
6. Wipe paper drive roller clean of any bits of paper and debris with alcohol and a nonabrasive material.

Completion

Perform the "System Performance Test" on page 4-9 to verify PRN 50-M and PRN 50 operation.

Performance Test

This chapter contains a procedure for testing the performance of the PRN 50-M and the PRN 50 Digital Writers. Some familiarity with the PRN 50-M and the PRN 50 Digital Writers is required for this procedure.

Frequency

Perform this procedure every three months or whenever a circuit board or other assembly is repaired or replaced.

Requirements

Connect the PRN 50-M or PRN 50 to a patient monitoring system to complete the following steps.

NOTE

Before plugging the PRN 50-M or PRN 50 power cord into a power receptacle, verify that the **I/O** power switch is OFF (**O**). Always use the power switch on the back to apply power.

1. Turn the PRN 50-M or PRN 50 power switch on the back panel ON (**I**). The DC motor should not "jerk" the paper and nothing should print on the paper.
2. Verify the **POWER** indicator (green LED) on the front panel illuminates.
3. Observe the **PAPER OUT** indicator (yellow LED) on the front panel does not illuminate.

   If there is paper in the paper compartment, the LED should illuminate briefly at start-up and then extinguish.

   If there is no paper in the paper compartment, load paper in the thermal writer. Press the **GRAPH STOP** button to aid in loading the paper.
4. Press and hold the **GRAPH STOP** button for at least 10 seconds. The writer should print out the revision of operating software currently installed on the processor PCB with the alphanumeric test pattern shown below.

   Verify that the alphanumerics print clearly and are uniform in size and contrast. If the printing is not uniform, clean the printhead and try again. If the printer still fails, call GE Medical Systems *Information Technologies* for service.

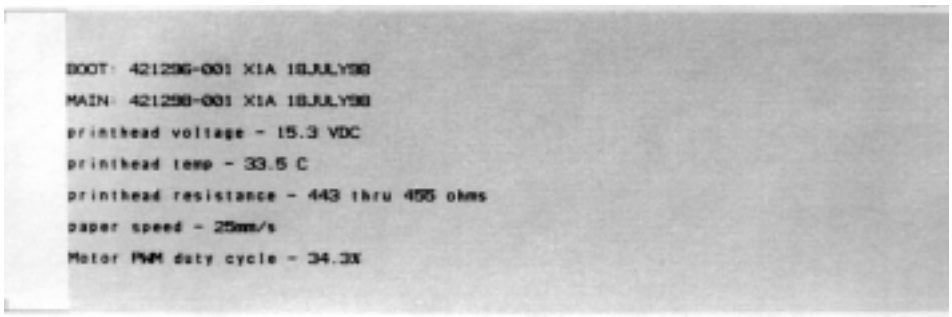
Print Quality

After the alphanumerics print, continue to hold the **GRAPH STOP** button until the first test pattern is visible, then release. A series of three test patterns follow to allow you to check the print quality.

To stop the test pattern at any time cycle the power by turning the power switch off and then back on. Pressing the **GRAPH STOP** button while the test pattern is running only changes the paper speed.

First Test Pattern

The first test pattern is used to check the roller for flat spots and other irregularities. With this test the pattern you should see a uniform gray background with no light spots or gaps. Check the roller for dirt or damage if this test fails.

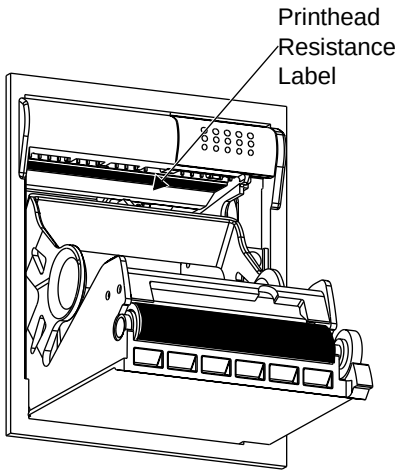

BOOT: 421296-001 X1A 18JULY98
MAIN: 421298-001 X1A 18JULY98
printhead voltage = 15.3 VDC
printhead temp = 33.6 C
printhead resistance = 443 thru 455 ohms
paper speed = 25mm/s
Motor PWM duty cycle = 34.3%

Text

At the start of each test pattern are printed seven lines of text. Verify that all text and patterns are satisfactory as follows:

First and second lines – The first two lines consist of a GE Medical Systems *Information Technologies*' part number, software revision, and date for the Boot and Main software.

Third line – Printed on the third line is the measured printhead voltage.



Forth line – The forth line shows the measured printhead temperature in degrees centigrade. This temperature varies between 20 and 50 degrees and depends on the ambient temperature and what is printing.

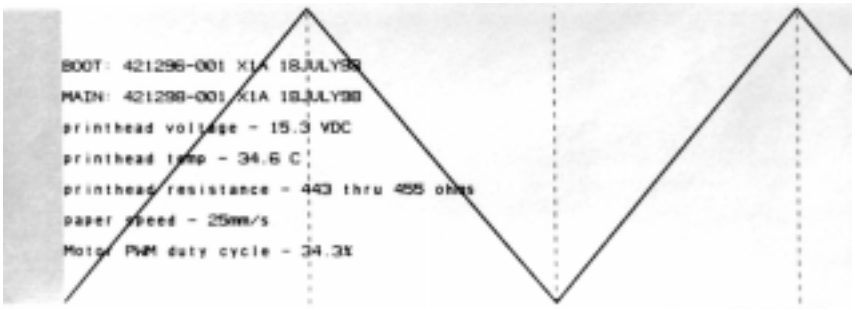
Fifth line – The fifth line is the printhead resistance range. The exact printhead resistance range of your writer is printed on a label affixed to the printhead which you can view by opening the paper carriage door as shown in the drawing at the left. The resistance value printed on this label should be within the range printed on the fifth line.

Sixth line – Printed on the sixth line is the speed the test patterns are printing.

Seventh line – Printed on the seventh line is the duty cycle of percent of time the drive motor is on.

Second Test Pattern

The second test pattern is used for checking printhead alignment, speed accuracy, and speed regulation.


BOOT: 421296-001 X1A 18JULY98
MAIN: 421298-001 X1A 18JULY98
printhead voltage - 15.3 VDC
printhead temp - 34.6 C
printhead resistance - 443 thru 455 ohms
paper speed - 25mm/s
Motor PWM duty cycle - 34.3%

Printhead alignment – The two end most elements on the printhead are turned on to form continuous lines on the edges of the paper. These lines should always be visible. A light or missing line is an indication of possible misalignment.

Speed accuracy – The grid pattern is printed to show speed control accuracy. A marker at 75mm intervals along the bottom of the strip is used for checking accuracy. To verify accuracy, place a 300mm ruler on the first 75mm marker. The fifth 75mm marker should be at 300mm ± 6mm

Speed regulation – The triangular pattern is used to quickly check speed regulation. The lines forming the triangle should be straight. Any "bumps" in the lines would be an indication of a speed control problem.

Third Test Pattern

This test pattern is not shown and used for production tests only.

System Performance Test

Procedure

This part of the system performance testing is done with the PRN 50-M or PRN 50 connected to a patient monitoring system. Do the following steps in the order given.

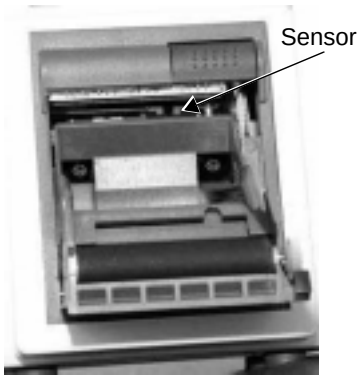
Setup

1. Connect a simulator to the patient monitor. Simulate a patient's ECG on the display. Refer to the appropriate user manual.
2. Depress any graph button and verify that the PRN 50-M or PRN 50 is printing the same information displayed on the CRT monitor.

Test Speeds and Header Information

1. Change the speed of the graph on the monitor through all eight speeds. Verify that the PRN 50-M or PRN 50 operates at the speed indicated on the monitor. Graph a complete header of one ECG waveform for the 25, 50, and 12.5 mm/s speeds.
2. Examine the header verifying that the printed information is correct and legible.

Test PAPER OUT Indicator

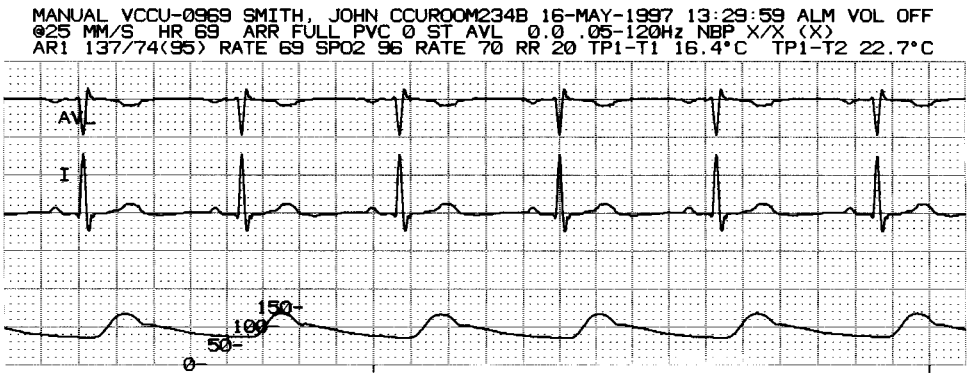


You need a short length of paper for this part of the test.

1. Open the paper compartment.
2. Check that there is no debris blocking the paper sensor.
3. Turn the roller *counterclockwise* until approximately 12 inches of paper are available.
4. Tear paper near the roller, releasing a 12-inch strip from the full roll.
5. Wrap the 12-inch strip back around the full paper roll.
6. Feed 4 inches out of the paper compartment and close the door.
7. Press the graph button on the monitor until the 12 inches of paper runs out. Three things should happen:
   - The PRN 50-M or PRN 50 should stop printing before the last of the paper leaves the door slot.
   - The **PAPER OUT** (yellow LED) should illuminate.
   - When a graph is attempted at the monitor, a *NO PAPER* message should display on the monitor CRT.
8. Reload the full paper roll and feed 4 inches out of the paper compartment and close the door.

Test System Communications

Press any graph key on the monitor. The output should be similar to that shown below. Verify that the grid is present and that the patient data and other information including the date are legible.


MANUAL VCCU-0969 SMITH, JOHN CCUROOM234B 16-MAY-1997 13:29:59 ALM VOL OFF
@25 MM/S HR 69 ARR FULL PVC 0 ST AVL 0.0 .05-120Hz NBP X/X (X)
AR1 137/74(95) RATE 69 SPO2 96 RATE 70 RR 20 TP1-T1 16.4°C TP1-T2 22.7°C
AVL
I
150-
100-
50-
0-

Fault Mode

If the printer stops graphing and the green Power LED starts flashing:

- the motor may have stalled,
- the printhead may have overheated, or
- the printhead voltage is out of specification.

The green **Power** LED then continues to flash until the next graph, when it reverts to a “steady on” state.

Completion

If the above conditions have been met, the PRN 50-M or PRN 50 is performing properly.

Electrical Safety Tests

General

Electrical safety tests provide a method of determining if potential electrical health hazards to the operator of the device exist.

Recommendations

To help you establish a systematic maintenance routine, GE Medical Systems *Information Technologies* recommends that you perform all safety tests presented in this chapter:

- upon receipt of the device,
- every twelve months thereafter,
- each time the main enclosure is disassembled or a circuit board is removed, tested, repaired, or replaced, and
- record the date and results on the "Maintenance/Repair Log" included at the end of this chapter.

CAUTION
Failure to implement a satisfactory maintenance schedule may cause undue equipment failure and possible health hazards. Unless you have an Equipment Maintenance Contract, GE Medical Systems *Information Technologies* does not in any manner assume the responsibility for performing the recommended maintenance procedures. The sole responsibility rests with the individual or institution using the equipment. GE Medical Systems *Information Technologies* personnel may, at their discretion, follow the procedures provided in this manual as a guide during visits to the equipment site.

Test Conditions

Electrical safety tests may be performed under normal ambient conditions of temperature, humidity, and pressure.

Test Equipment

The manufacturer recommended test equipment required to perform electrical safety tests is listed below. Equivalent equipment may be substituted as necessary.

Table 1. Required Tools/Special Equipment	
Item	**Part Number**
Leakage Current Tester 120 V (or equivalent) 240 V (or equivalent)	 MT-1216-01 MT-1216-02
Multimeter	–

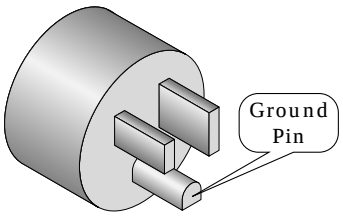
Wall Receptacle Test

Before starting the tests, the wall receptacle from which the device will get electrical power must be checked. This test checks the condition of the wall receptacle to ensure correct results from leakage tests.

For international wall receptacles, refer to the internal standards agencies of that particular country. Use a digital multimeter to ensure the wall receptacle is wired properly.

If other than normal polarity and ground is indicated, corrective action must be taken before proceeding. The results of the following tests will be meaningless unless a properly wired wall receptacle is used.

Ground (Earth) Integrity



Listed below are two methods for checking the ground (earth) integrity, “Ground Continuity Test” and “Impedance of Protective Earth Connection.” These tests determine whether the device's exposed metal and power inlet's earth (ground) connection has a power ground fault condition.

Perform the test method below that is required by your Country/Local governing safety organization.

Ground Continuity Test

Completion of this test is checked by the following steps:

1. Disconnect the DUT (device under test) from the wall receptacle.
2. Connect the negative(-) lead of the ohm meter to the protective earth terminal (ground pin in power in-let connector) or the protective earth pin in the MAINS PLUG (ground pin in power cord). Refer to the US 120Vac power cord figure on the left.
3. Set the Ohm meter to the milliohm (mΩ) range.

4. Connect the positive (+) lead of the Ohm meter to all exposed metal surfaces on the DUT. If the metal surfaces are anodized or painted scrape off a small area in a inconspicuous area for the probe to make contact with the metal.
5. Resistance should read to pass:
   - 0.1 ohm or less without power cord
   - 0.2 ohms or less with power cord

Impedance of Protective Earth Connection

This test unlike a ground continuity test will also stress the ground system by using special ground bond testers i.e. Kikusui (model 872 or TOS 6100) or Associated Research model HYAMP® Jr. Model 3030D.

This test normally is only required as a manufacturing production test to receive safety agency compliance (i.e. IEC601-1).

Some country agency's do require this test after field equipment repairs (i.e. Germany's DIN VDE 0751 standards).

Consult your country/local safety agency if in question.

Compliance is checked by the following steps:

1. A current not less than 10A and not exceeding 25 A from a current source with a frequency of 50 or 60 Hz with a no-load voltage not exceeding 6 V is passed for at least 5 s through the PROTECTIVE EARTH TERMINAL or the protective earth pin in the MAINS PLUG and each ACCESSIBLE METAL PART which could become LIVE in case of failure in BASIC INSULATION.
2. The voltage drop between the parts described is measured and the impedance determined from the current and voltage drop. It shall not exceed the values indicated.

For EQUIPMENT without a POWER SUPPLY CORD the impedance between the PROTECTIVE EARTH TERMINAL and any ACCESSIBLE METAL PART which is PROTECTIVELY EARTHED shall not exceed 0.1 ohms

For EQUIPMENT with a POWER SUPPLY CORD the impedance between the protective earth pin in the MAINS PLUG and any ACCESSIBLE METAL PART which is PROTECTIVELY EARTHED shall not exceed 0.2 ohms.

When taking this measurement move the customer's power cord around, no fluctuations in resistance should be observed.

Ground (Earth) Wire Leakage Current Tests

Perform this test to measure current leakage through the ground (earth) wire of the equipment during normal operation.

1. Set the leakage tester switches as follows:
   - Selector knob - 1,
   - GND switch - OPEN,
   - Polarity switch - NORM,
   - Power switch - OFF.
2. Connect the DMM to the METER jacks on the leakage tester. Set the DMM to measure AC millivolts.
3. Connect the power cord of the device under test to the power receptacle on the rear of the leakage tester.

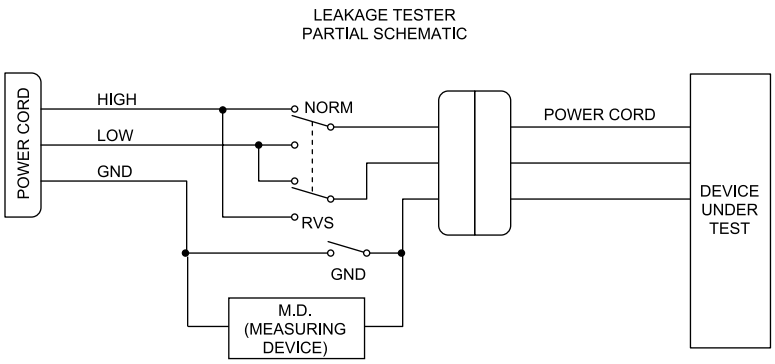
   NOTE
   The device under test is to be tested at its normal operating voltage.
4. Set the leakage tester power switch to ON.
5. Set the power switch of the device under test to ON.
6. Read the current leakage indicated on DMM. If the reading is greater than the appropriate specification below, the device under test fails and should be repaired and tested again.
   - 300 µA (0.3 volts on the DMM), and the device under test is powered from 100-120 V/50-60 Hz
   - 300 µA (0.3 volts on the DMM), and the device under test is powered from a centered-tapped 200-240 V/50-60 Hz, single phase circuit
   - 500 µA (0.5 volts on the DMM), and the device under test is powered from a non-center-tapped, 200-240 V/50-60 Hz, single-phase circuit

   NOTE
   Center-tapped and non-center-tapped circuits produce different leakage currents and the UL and IEC limits are different.
7. Set the polarity switch on the leakage tester to RVS (reverse).

8. Read the current leakage indicated on DMM. If the reading is greater than the appropriate specification below, the device under test fails and should be repaired and tested again.
   - 300 µA (0.3 volts on the DMM), and the device under test is powered from 100-120 V/50-60 Hz
   - 300 µA (0.3 volts on the DMM), and the device under test is powered from a centered-tapped 200-240 V/50-60 Hz, single phase circuit
   - 500 µA (0.5 volts on the DMM), and the device under test is powered from a non-center-tapped, 200-240 V/50-60 Hz, single-phase circuit

   NOTE
   Center-tapped and non-center-tapped circuits produce different leakage currents and the UL and IEC limits are different.

9. Set the leakage tester power switch to OFF.



NOTE
The MD (measuring device) is the circuitry defined by the appropriate standard for measuring leakage current.

The measuring devices, defined by various standard organizations (IEC, UL, etc.), produce almost identical test measurement results.

Enclosure Leakage Current Test

Perform this test to measure current leakage through exposed conductive surfaces on the device under test during normal operation.

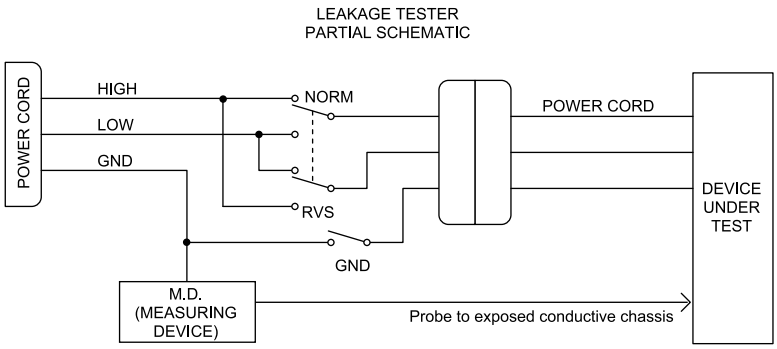
1. Set the leakage tester switches as follows:
   - Selector knob - 2,
   - GND switch - OPEN,
   - Polarity switch - NORM.

2. Connect a meter lead between the CHAS connector on the rear of the leakage tester and an unpainted, non-anodized chassis ground on the unit under test.

3. Set the leakage tester power switch to ON.

4. Read the current leakage indicated on DMM. If the reading is greater than the appropriate specification below, the device under test fails and should be repaired and tested again.
   - 300 µA (0.3 volts on the DMM), and the device under test is powered from 100-120 V/50-60 Hz
   - 300 µA (0.3 volts on the DMM), and the device under test is powered from a centered-tapped 200-240 V/50-60 Hz, single phase circuit
   - 500 µA (0.5 volts on the DMM), and the device under test is powered from a non-center-tapped, 200-240 V/50-60 Hz, single-phase circuit

   NOTE
   Center-tapped and non-center-tapped circuits produce different leakage currents and the UL and IEC limits are different.
5. Set the polarity switch to RVS and observe the same meter readings as in the previous step.
6. Set the GND switch on the leakage tester to CLOSED.
7. Read the current leakage indicated on DMM. If the reading is greater than the appropriate specification below, and the device under test is powered from 100-240 V/50-60 Hz, the device under test fails and should be repaired and tested again.
   - 100 microamperes (0.1 volts on the DMM), and the device under test is powered from 100-240 V/50-60 Hz
8. Set the polarity switch to RVS and observe the same meter readings as in the previous step.
9. Set the leakage tester power switch to OFF and remove the meter lead connected in step 2.



Test Completion

Disconnect all test equipment from the device. Disconnect the device power cord plug from the leakage tester power receptacle. Disconnect the leakage tester from the wall receptacle.

5 Upper Level Assembly

For your notes

General

Upper Level

This section provides identification and ordering information for the upper level assembly replacement parts of the PRN 50-M and PRN 50 Digital Writers.

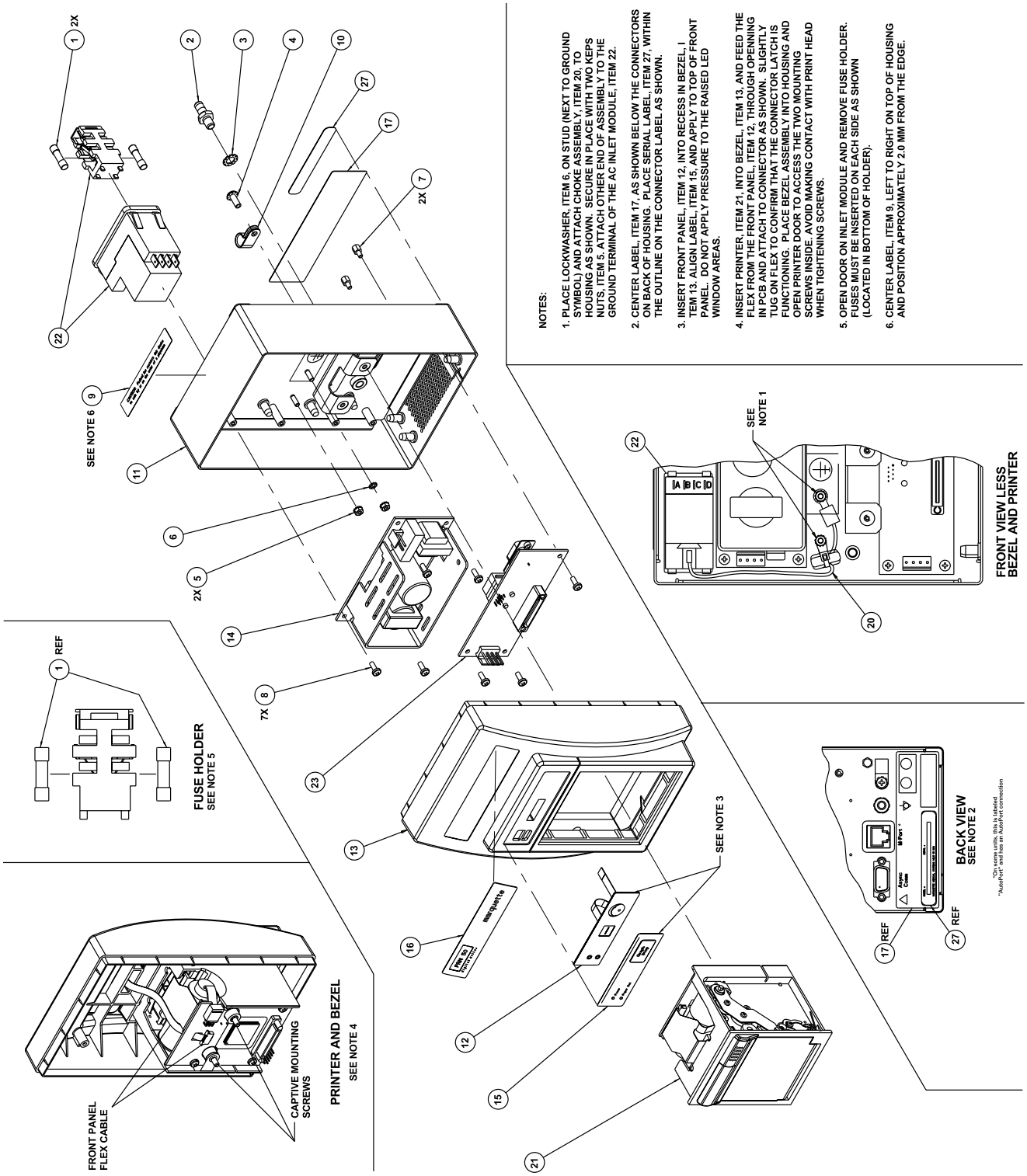
Circuit board, parts placement, and schematic diagrams are found in the next section of this manual.

CAUTION
This assembly is extremely static sensitive and should be handled using the precautions described in "Controlling Electrostatic Discharge Damage" on page 3-4 of this manual.

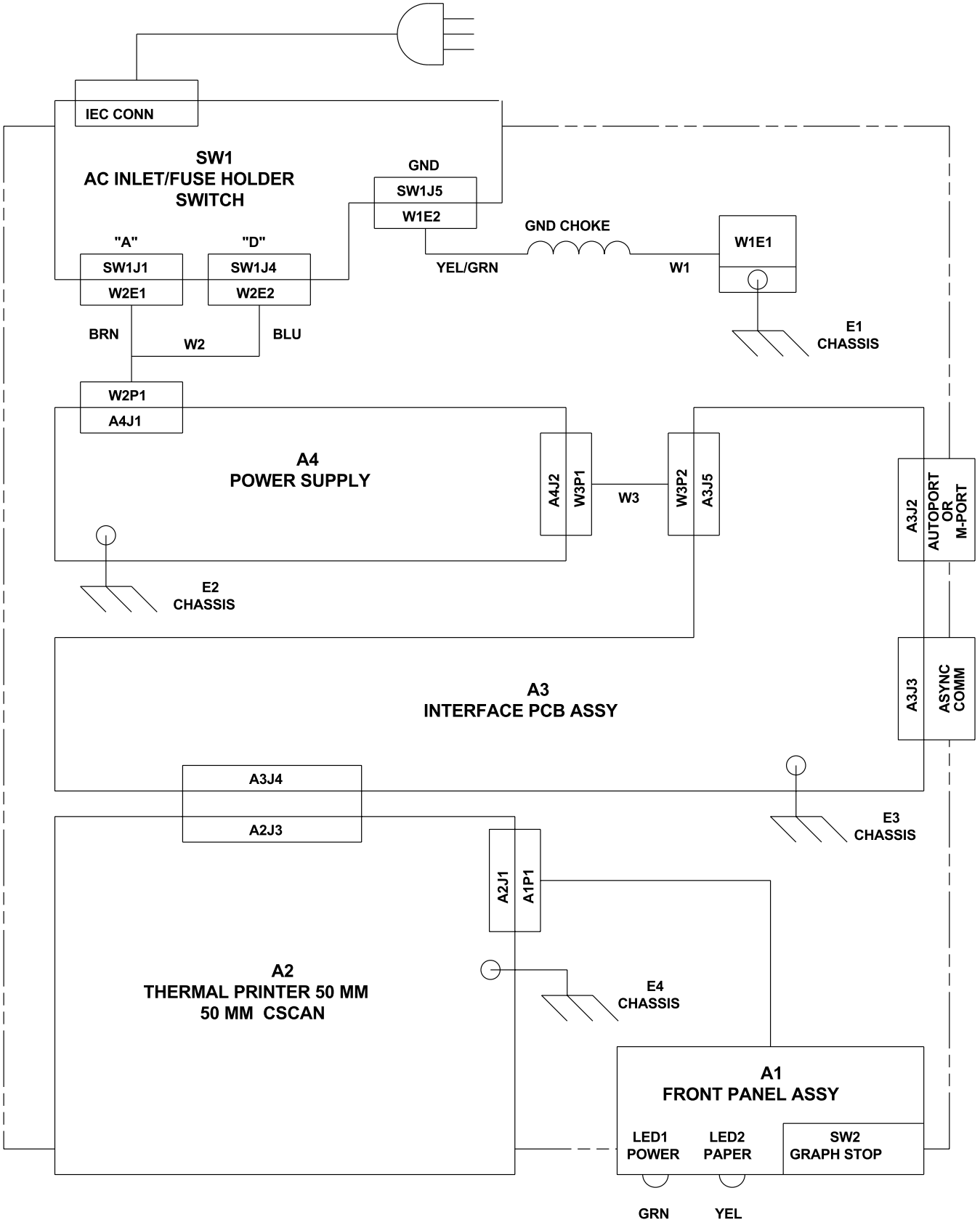
Parts List 418331-001B

Table 1. Upper Level Parts List			
Item	**Description**	**Part Number**	**Qty.**
1	Fuse, 800 MA, Time Lag, 5*x*20MM	409801-003	2
2	Plug, MC, Equipotential	400040-001	1
3	Washer, Lock, Serrated, F/M6	400041-001	1
4	Screw, M4-.7*x*10, Sems	411061-001	1
5	Nut, Hex Kep, M3-.5, Class 8 Zp	411323-001	2
6	Washer, Lock, M3, Ext, Tooth	412048-001	1
7	Jackscrew, 4-40 *x* .18, W/Vibratite	412302-001	2
8	Screw, PH, M3 x 6MM	45209-306	7
10	Clamp, Cable	415363-001	1
11	Housing, PRN50	417828-001	1
12	Membrane, Front Panel, PRN50, A1	417921-001	1
13	Bezel, Qube, Non-Shielded	417980-003	1
14	Pwr Sply, 15V, 40W, Open Frame, A4	418966-001	1
18	Harness, PS/PWR, Mdl, Rac, 2A:W2	419573-001	1
19	Harness, PS/Main, PCB, Rac, 2A:W3	419574-001	1
20	Choke Assy, 6.5 LG, W1	419575-002	1
21	Thermal Printer, 50MM, CS2, A2	419743-002	1
22	AC Inlet Module Conn/SW/Dual, FZ, SW1	420205-001	1
23	PCB PRN 50-M (M-Port) Interface (See "Parts List 801390-002A" on page 6-7)	801390-002	1
	PCB PRN 50 (AutoPort) Interface (See "Parts List 801390-001A" on page 6-12)	801390-001	1
24	Packaging, Carton, Cube	411516-002	0
25	Packaging, Foam, Cube	421208-001	0
26	Carton, Accessory, Reverse Tuck	421208-002	0
27	Lable, Blank, 2.6 IN *x* .4 IN	404525-006	1
28	Paper Sample, 9402-046, 24/Case	4919-001	1
29	MNL SVCE PRN 50-M English	2006503-001	A/R

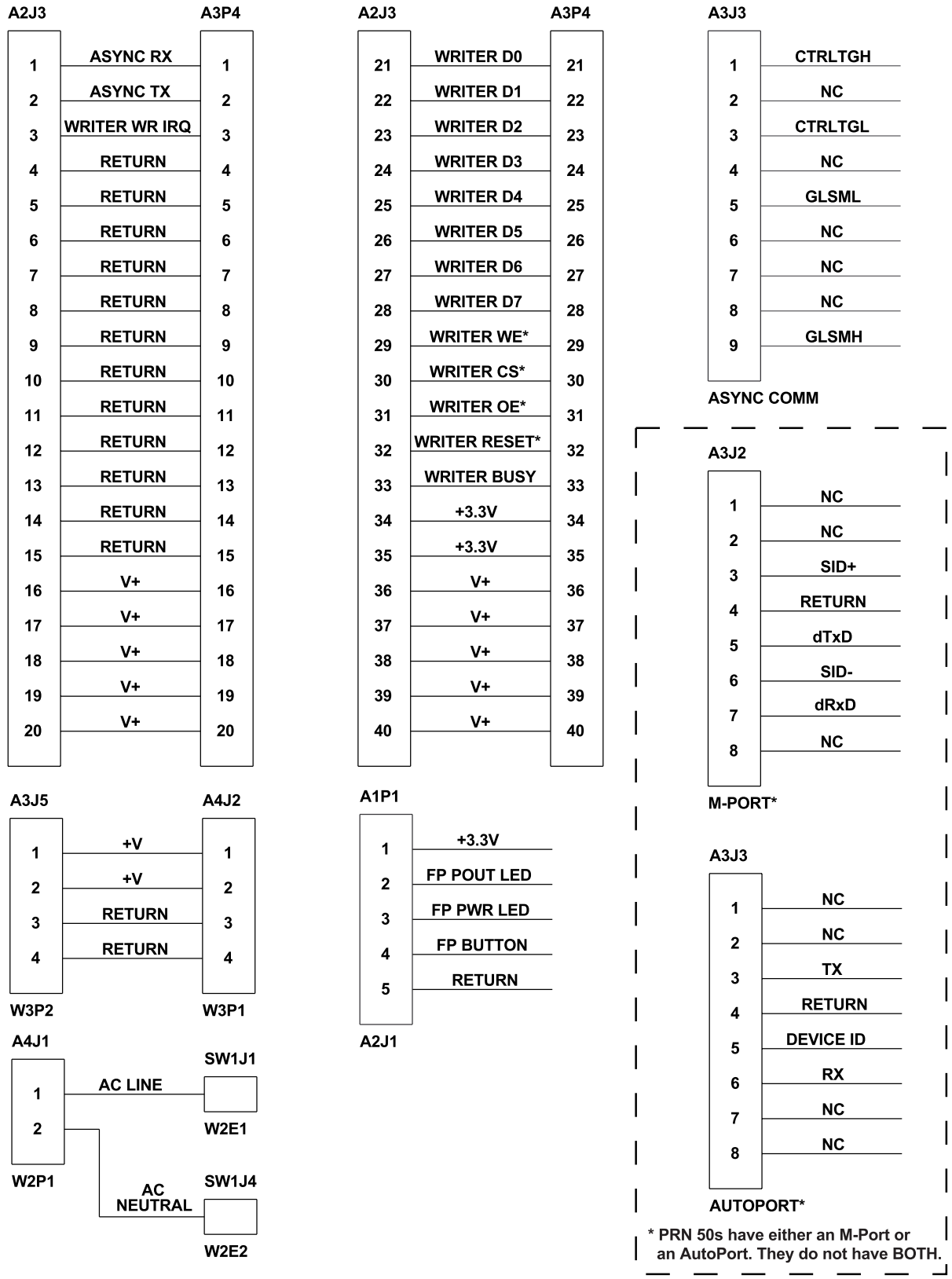
Exploded View


NOTES:
1. PLACE LOCKWASHER, ITEM 6, ON STUD (NEXT TO GROUND SYMBOL) AND ATTACH CHOKE ASSEMBLY, ITEM 20, TO HOUSING AS SHOWN. SECURE IN PLACE WITH TWO KEPS NUTS, ITEM 5. ATTACH OTHER END OF ASSEMBLY TO THE GROUND TERMINAL OF THE AC INLET MODULE, ITEM 22.
2. CENTER LABEL, ITEM 17, AS SHOWN BELOW THE CONNECTORS ON BACK OF HOUSING. PLACE SERIAL LABEL, ITEM 27, WITHIN THE OUTLINE ON THE CONNECTOR LABEL AS SHOWN.
3. INSERT FRONT PANEL, ITEM 12, INTO RECESS IN BEZEL, ITEM 13. ALIGN LABEL, ITEM 15, AND APPLY TO TOP OF FRONT PANEL. DO NOT APPLY PRESSURE TO THE RAISED LED WINDOW AREAS.
4. INSERT PRINTER, ITEM 21, INTO BEZEL, ITEM 13, AND FEED THE FLEX FROM THE FRONT PANEL, ITEM 12, THROUGH OPENNING IN PCB AND ATTACH TO CONNECTOR AS SHOWN. SLIGHTLY TUG ON FLEX TO CONFIRM THAT THE CONNECTOR LATCH IS FUNCTIONING. PLACE BEZEL ASSEMBLY INTO HOUSING AND OPEN PRINTER DOOR TO ACCESS THE TWO MOUNTING SCREWS INSIDE. AVOID MAKING CONTACT WITH PRINT HEAD WHEN TIGHTENING SCREWS.
5. OPEN DOOR ON INLET MODULE AND REMOVE FUSE HOLDER. FUSES MUST BE INSERTED ON EACH SIDE AS SHOWN (LOCATED IN BOTTOM OF HOLDER).
6. CENTER LABEL, ITEM 9, LEFT TO RIGHT ON TOP OF HOUSING AND POSITION APPROXIMATELY 2.0 MM FROM THE EDGE.
FRONT VIEW LESS BEZEL AND PRINTER
SEE NOTE 1
BACK VIEW
SEE NOTE 2
*On some units, this is labeled "AutoPort" and has an AutoPort connection
FUSE HOLDER
SEE NOTE 5
PRINTER AND BEZEL
SEE NOTE 4
SEE NOTE 3
FRONT PANEL FLEX CABLE
CAPTIVE MOUNTING SCREWS
SEE NOTE 6
2X
7X
REF

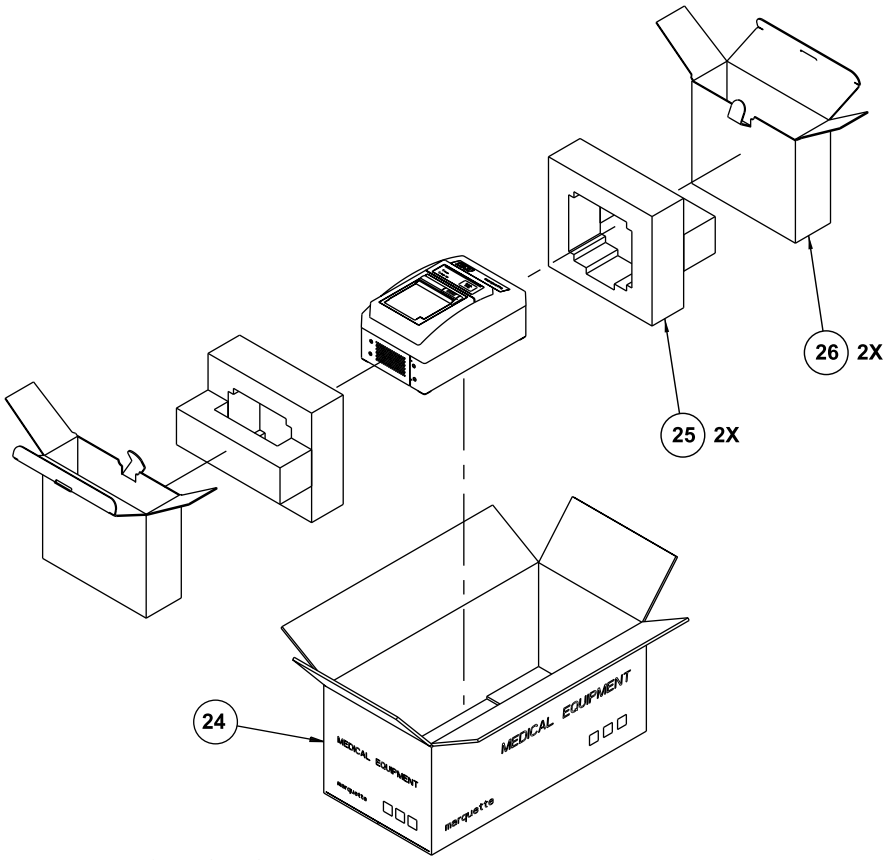
Block Diagram



Wiring Diagram



Packaging



PACKAGING DETAIL

NOTE :

PLACE FINISHED UNIT IN FOAM INSERTS AS SHOWN. ANY ACCESSORIES SHOULD BE PLACED INSIDE THE TWO CARDBOARD INSERTS IF SPACE PERMITS. WHEN A PEDESTAL KIT IS INCLUDED, DO NOT PLACE OTHER ACCESSORIES INSIDE THE SAME INSERT.

6 Interface PCB

For your notes

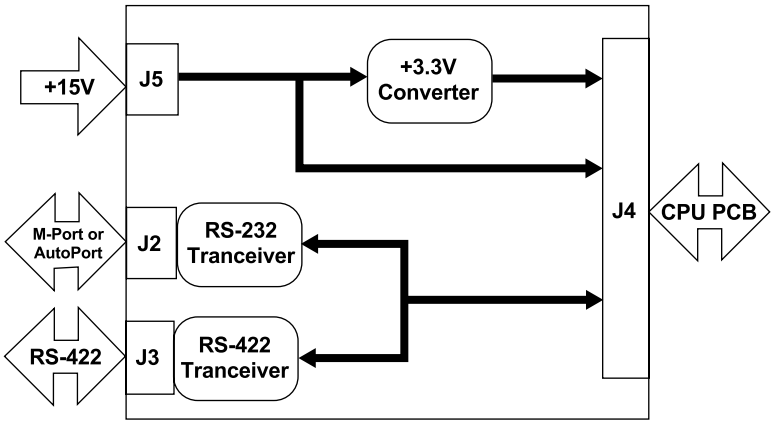
General

The purpose of the 801390-002 (PRN 50-M) and 801390-001 (PRN 50) Interface PCBs is to provide power distribution and interface electronics for the PRN 50-M and PRN 50 Digital Writers.

CAUTION
This assembly is extremely static sensitive and should be handled using the precautions described in "Controlling Electrostatic Discharge Damage" on page 3-4 of this manual.

Theory

The 801390-002 (PRN 50-M) and 801390-001 (PRN 50) Interface PCBs provide power distribution and interconnection for the PRN 50-M and PRN 50 Digital Writers. Two host interfaces are provided for. Use the RS-232 (M-Port or AutoPort) interface with newer hosts. An RS-422 interface is provided to maintain compatibility with the 7160 DDW. All hosts that connect to the 7160 DDW can connect to the PRN 50-M and PRN 50. All the necessary supply voltages for the PRN 50-M and PRN 50 are generated and distributed on this board. A serial EEPROM is used to store the necessary identification information.



+3.3V Switching Regulator Circuit

The +V power source uses a LM2674 step-down (buck) regulator to generate a +3.3VDC logic supply. This board and the 801406-001 CPU board uses this +3.3VDC logic supply. The LM2674 series operates at a switching frequency of 260kHz with a typical efficiency of 86%. The LM2674 contains an internal FET switching at 260kHz which, when turned on, drives an increasing current from Vin (pin 7) through the inductor L1 to the output capacitor C7 and to the load. Energy is stored in the inductor as the current increases with time. When the FET switch turns off, the collapse of the magnetic field in L1 forces current to flow through the catch diode CR1, charging C7. The output capacitor C7 is a low ESR capacitor used to filter the output voltage.

+5VDC Linear Regulator

A +5VDC supply is generated from the +V power source using a 78M05 DPAK linear regulator. This supply if used by the RS-422 interface circuitry.

Serial EEPROM

The serial EEPROM stores the identification information required for all AutoPort devices. The EEPROM control, address, data, and power are all handled by one pin. After the unit has been assembled, the unit type number and model number are programmed into the EEPROM. The following is the type number, and the various model numbers:

Table 2. Type Number

Device	Type #
device_mms_print	11

Table 3. Model Number

Unit	Model #
device_mms_print_prn50	1

RS-422 Transceiver

The RS-422 transceiver is used to convert the CPU transmitted data from +3.3V logic levels to RS-422 levels, and convert the received RS-422 data from the host to +3.3V logic levels. The transceiver contains one optically isolated receiver and one transmitter, and requires a +5VDC supply.

RS-232 Transceiver (M-Port)

The RS-232 transceiver is used to convert the CPU transmitted data from +3.3V logic levels to RS-232 logic levels, and convert the received RS-232 data from the host to +3.3V logic levels. The transceiver contains one receiver and one transmitter, and only requires a single supply and four external capacitors.

Power Supply Requirements

Table 4. Power Supply Requirements			
Voltage	**Limits**	**Current**	**J5**
+15V	+14V to +16V	75 mA	1, 2

Input / Output Signal Requirements

J1 Connector

Table 5. Connector (J1)				
Pin #	**Signal Name**	**Level**	**Direction**	**Description**
1	CTRLTGH	RS-422	Output	RS422 differential drive
2			nc	5V ground
3	CTRLTGL	RS-422	Output	RS422 complement differential drive
4			nc	no connection
5	GLSML	RS-422	Input	Anode side input
6			nc	no connection
7			nc	no connection
8			nc	no connection
9	GLSMH	RS-422	Input	Cathode side input
shell	CHASSIS			chassis ground

J2 Connector–M-Port

Table 6. RJ45 Connector (J2) (M-Port; 801390-002)				
Pin #	**Signal Name**	**Level**	**Direction**	**Description**
1	NC			
2	NC			
3	SID+	RS-232	Output	RS-232 transmit
4	RETURN	Power	Input	RS-232 signal common
5	dTxD	TTL	Bi-directional	Device identification
6	SID–	RS-232	Input	RS-232 receive
7	dRxD	TTL	Input	RS-232 clear-to-send
8	NC			

J2 Connector–AutoPort

Table 7. RJ45 Connector (J2) (AutoPort; 801390-001)				
Pin #	**Signal Name**	**Level**	**Direction**	**Description**
1	NC			
2	NC			
3	TX	RS-232	Output	RS-232 transmit
4	RETURN	Power	Input	RS-232 signal common
5	DEVICE_ID	TTL	Bi-directional	Device identification
6	RX	RS-232	Input	RS-232 receive
7	NC			
8	NC			

J5 Connector

Table 8. Power Connector (J5)				
Pin #	**Signal Name**	**Level**	**Direction**	**Description**
1	+V	Power	Input	input positive supply
2	+V	Power	Input	input positive supply
3	RETURN	Power	Input	input return supply
4	RETURN	Power	Input	input return supply

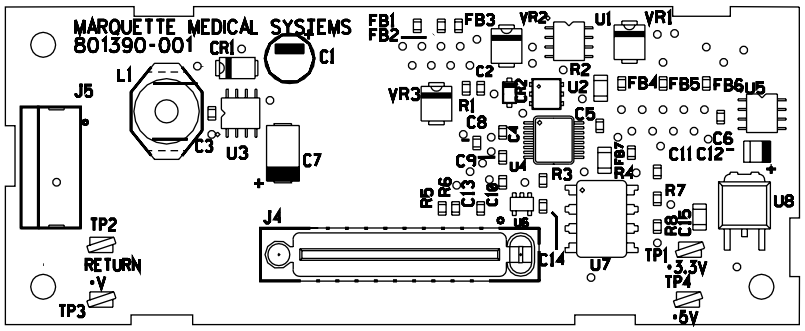
Parts List 801390-002A

Table 9. 801390-002 Parts List

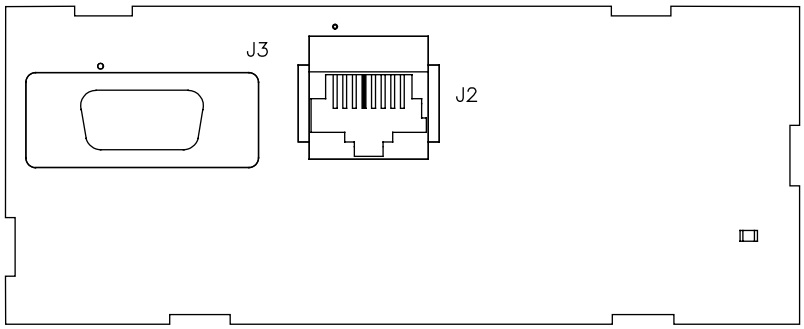
Reference Designation	Description	Part Number	Qty
C1	Cap, AL, 22µF, 20%, 35V, 5MM, Low Z	419448-001	1
C2	Cap, Cer, 1000pF, 5%, 50V, SM	411575-003	1
C3, 5, 6, 11, 14	Cap, Cer, 0.1µF, 5%, 50V, SM	411575-012	5
C4, 8, 9, 10, 13	Cap, Cer, 0.1µF, 5%, 16V	411575-002	5
C7	Cap, Tant, 100µF, 10%, 10V, SM	415802-001	1
C12	Cap, Tant, 3.3µF, 10%, 16V, SM	406883-005	1
C15	Cap, Cer, 0.1µF, X7R, 50V, SM	1187-104	1
CR1	Diode, Schottky, Barrier, 1A, 40V, SM MBRS140T3	403187-001	1
CR2	Diode, Rectifier, Schottky, SM MBR0520	413970-001	1
FB1, 2, 3, 4, 5, 6, 7	Ferrite Bead BLM11A601	414061-001	6
J2	Connector, RJ45, Vertical, 8-Pin	1807-005	1
J3	Conn, Plug, 9 Pos, Vert	405104-001	1
J4	Conn, 40P, Vert, Blind Mate, Male	420610-001	1
J5	Connector, PC Header, 4-Pin - w/Locks	406492-004	1
L1	Inductor, 47µH, =1/-20%, 0.9A, SM	420713-001	1
R1	Res, Cer, 100¾, 1%, 1/16W, SM	410334-003	1
R2, 4	Res, Cer, 33.2 ¾, 1%, 1/8W, SM	1082-788	2
R3, 7	Res, Cer, 10K, 1%, 1/16W, SM	410334-013	2
R5	Res, Cer, 0¾, 1%, 1/16W, SM	410334-027	1
R8	Res, Cer, 1K, 1%, 1/16W, SM	410334-008	1
TP1, 2, 3, 4	PC Post	415396-001	4
U1	Diode Array, ESD/Overvoltage Protection, Six Pair, SM	412586-002	1
U2	IC, EEPROM, 1-Wire, 256 Bit, SM	417652-002	1
U3	IC, Reg, LM2674, 3.3 Switcher, SM	420714-001	1
U4	IC, Transceiver, MAX3221	419512-001	1
U5	Line Driver, Dual, SM 9638	407884-001	1
U6	AND Gate, 2-Input, Quad TC7S08F	409035-001	1
U7	Isolator, Optically-Coupled, SM 2602	407164-001	1
U8	Volt Rgltr, Pos 5V, 700mA, SM 78M05	412613-001	1
VR1, 2	Diode, 600W, 15V, SM	405485-001	2
VR3	Diode, Transient Voltage Suppressor, 5V, 600W P6SMB6.8AT1	403189-001	1

Parts Location Diagram 801390-002A

Top View

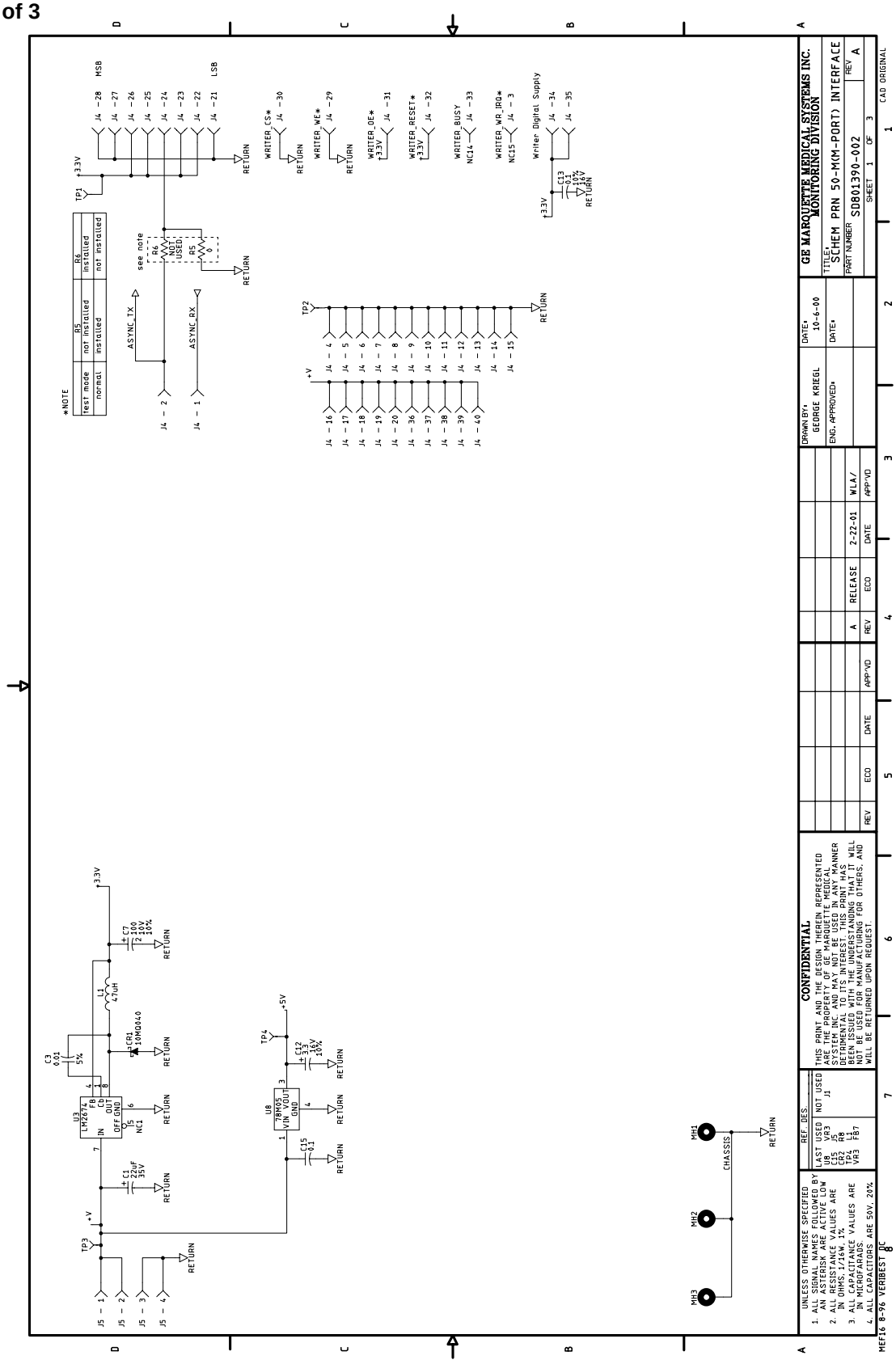


Bottom View

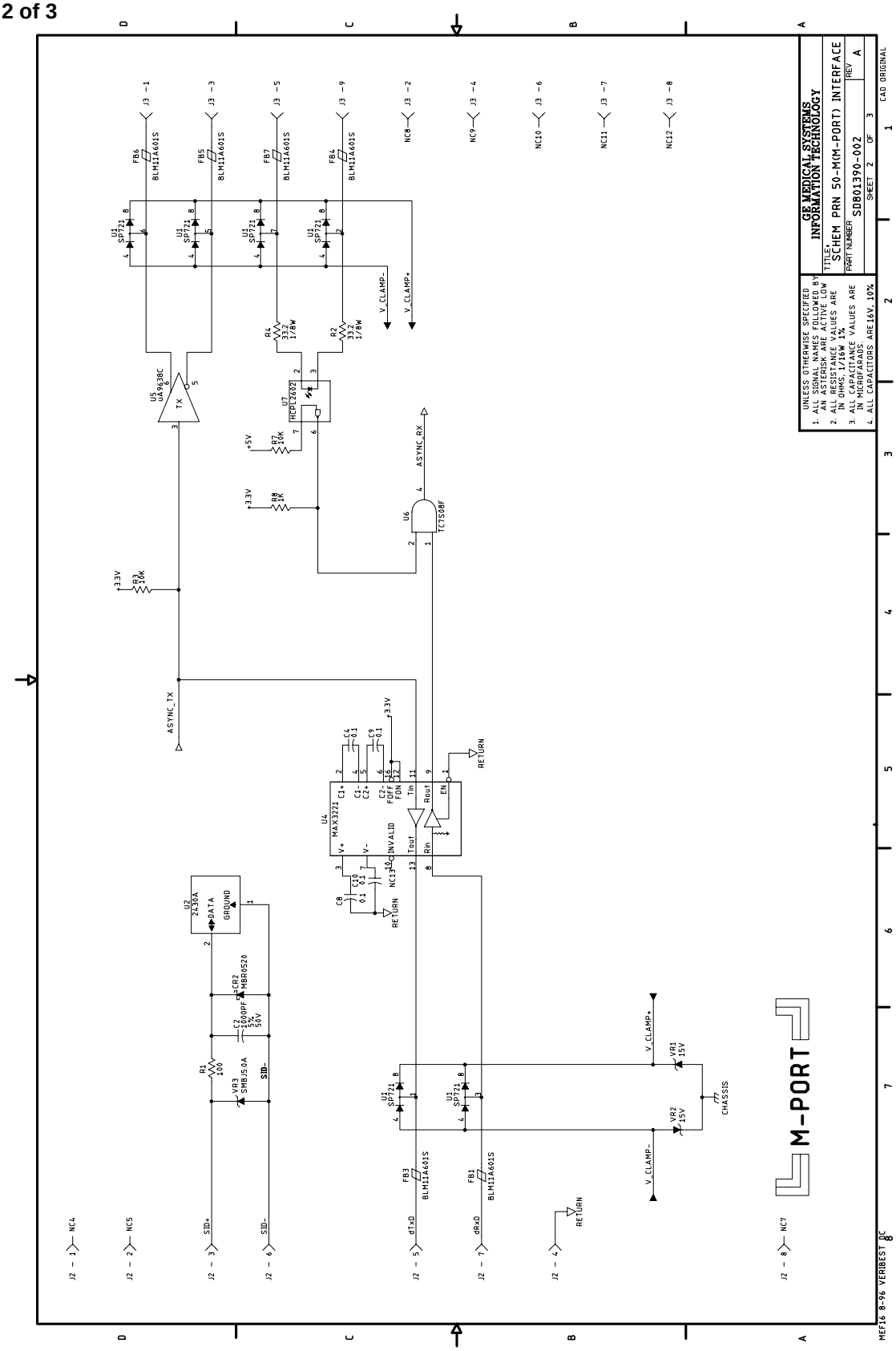


Schematic Diagram SD801390-002A

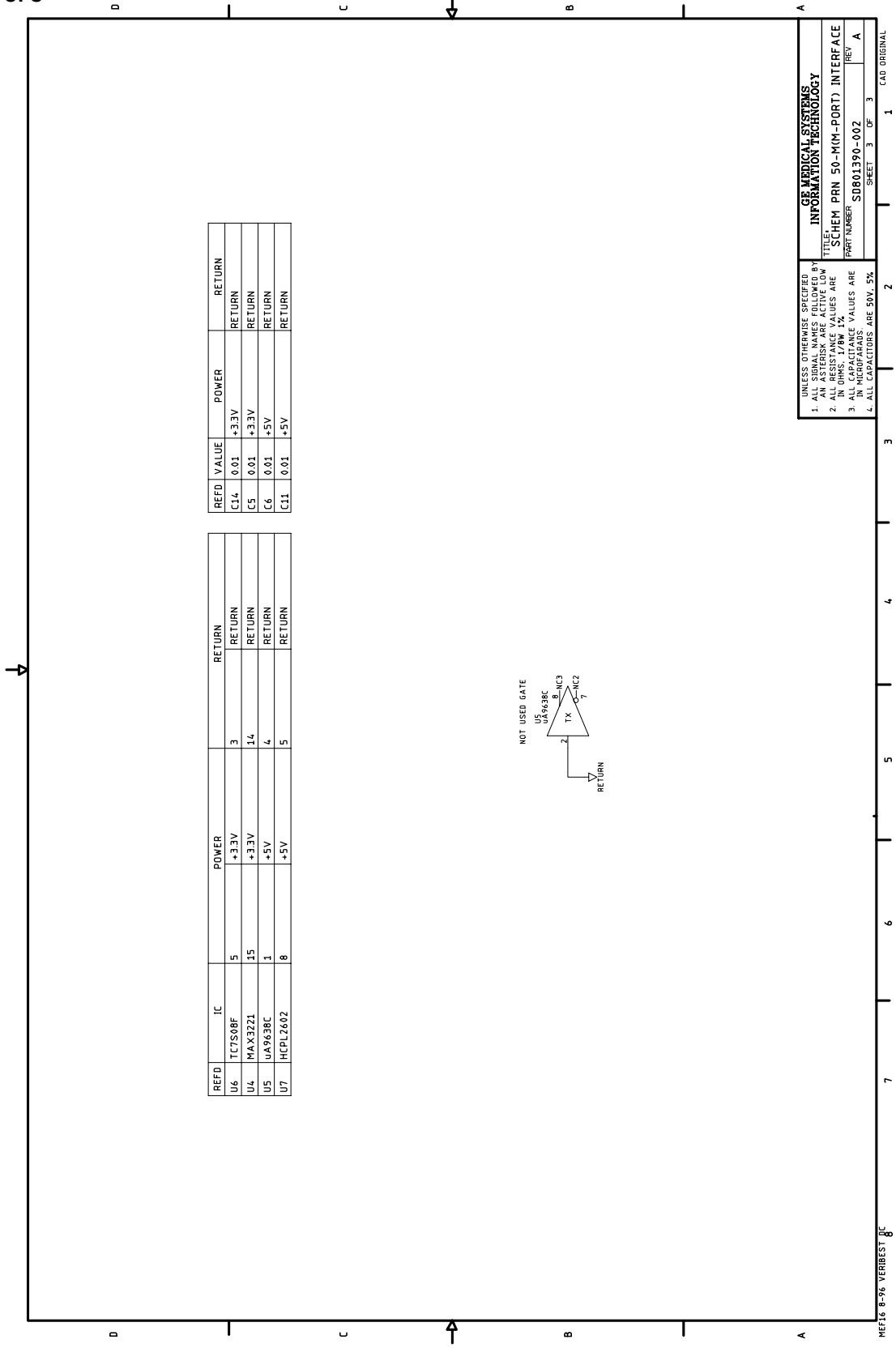
Sheet 1 of 3



Sheet 2 of 3


GE MEDICAL SYSTEMS
INFORMATION TECHNOLOGY
TITLE: SCHEM PRN 50-M(M-PORT) INTERFACE
PART NUMBER SD801390-002
REV A
SHEET 2 OF 3
CAD ORIGINAL
M-PORT
MEF16 8-96 VERIBEST INC

Sheet 3 of 3



REFD	IC	POWER		RETURN	
U6	TC7S08F	5	+3.3V	3	RETURN
U4	MAX3221	15	+3.3V	14	RETURN
U5	UA9638C	1	+5V	4	RETURN
U7	HCPL2602	8	+5V	5	RETURN

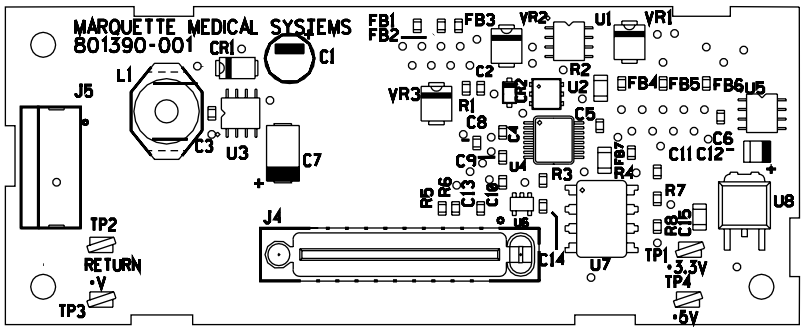
REFD	VALUE	POWER	RETURN
C14	0.01	+3.3V	RETURN
C5	0.01	+3.3V	RETURN
C6	0.01	+5V	RETURN
C11	0.01	+5V	RETURN

Parts List 801390-001A

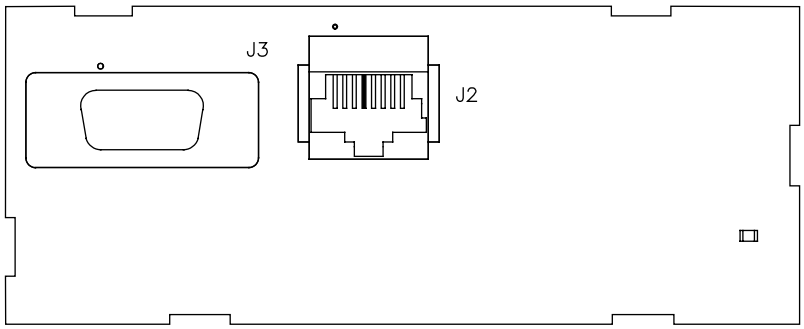
Table 10. 801390-002 Parts List			
Reference Designation	**Description**	**Part Number**	**Qty**
C1	Cap, AL, 22µF, 20%, 35V, 5MM, Low Z	419448-001	1
C2	Cap, Cer, 1000pF, 5%, 50V, SM	411575-003	1
C3, 5, 6, 11, 14	Cap, Cer, 0.1µF, 5%, 50V, SM	411575-012	5
C4, 8, 9, 10, 13	Cap, Cer, 0.1µF, 5%, 16V	411575-002	5
C7	Cap, Tant, 100µF, 10%, 10V, SM	415802-001	1
C12	Cap, Tant, 3.3µF, 10%, 16V, SM	406883-005	1
C15	Cap, Cer, 0.1µF, X7R, 50V, SM	1187-104	1
CR1	Diode, Schottky, Barrier, 1A, 40V, SM MBRS140T3	403187-001	1
CR2	Diode, Rectifier, Schottky, SM MBR0520	413970-001	1
FB1, 2, 3, 4, 5, 6, 7	Ferrite Bead BLM11A601	414061-001	7
J2	Connector, RJ45, Vertical, 8-Pin	1807-005	1
J3	Conn, Plug, 9 Pos, Vert	405104-001	1
J4	Conn, 40P, Vert, Blind Mate, Male	420610-001	1
J5	Connector, PC Header, 4-Pin - w/Locks	406492-004	1
L1	Inductor, 47µH, =1/-20%, 0.9A, SM	420713-001	1
R1	Res, Cer, 100¾, 1%, 1/16W, SM	410334-003	1
R2, 4	Res, Cer, 33.2 ¾, 1%, 1/8W, SM	1082-788	2
R3, 7	Res, Cer, 10K, 1%, 1/16W, SM	410334-013	2
R5	Res, Cer, 0¾, 1%, 1/16W, SM	410334-027	1
R8	Res, Cer, 1K, 1%, 1/16W, SM	410334-008	1
TP1, 2, 3, 4	PC Post	415396-001	4
U1	Diode Array, ESD/Overvoltage Protection, Six Pair, SM	412586-002	1
U2	IC, EEPROM, 1-Wire, 256 Bit, SM	417652-002	1
U3	IC, Reg, LM2674, 3.3 Switcher, SM	420714-001	1
U4	IC, Transceiver, MAX3221	419512-001	1
U5	Line Driver, Dual, SM 9638	407884-001	1
U6	AND Gate, 2-Input, Quad TC7S08F	409035-001	1
U7	Isolator, Optically-Coupled, SM 2602	407164-001	1
U8	Volt Rgltr, Pos 5V, 700mA, SM 78M05	412613-001	1
VR1, 2	Diode, 600W, 15V, SM	405485-001	2
VR3	Diode, Transient Voltage Suppressor, 5V, 600W P6SMB6.8AT1	403189-001	1

Parts Location Diagram 801390-001A

Top View

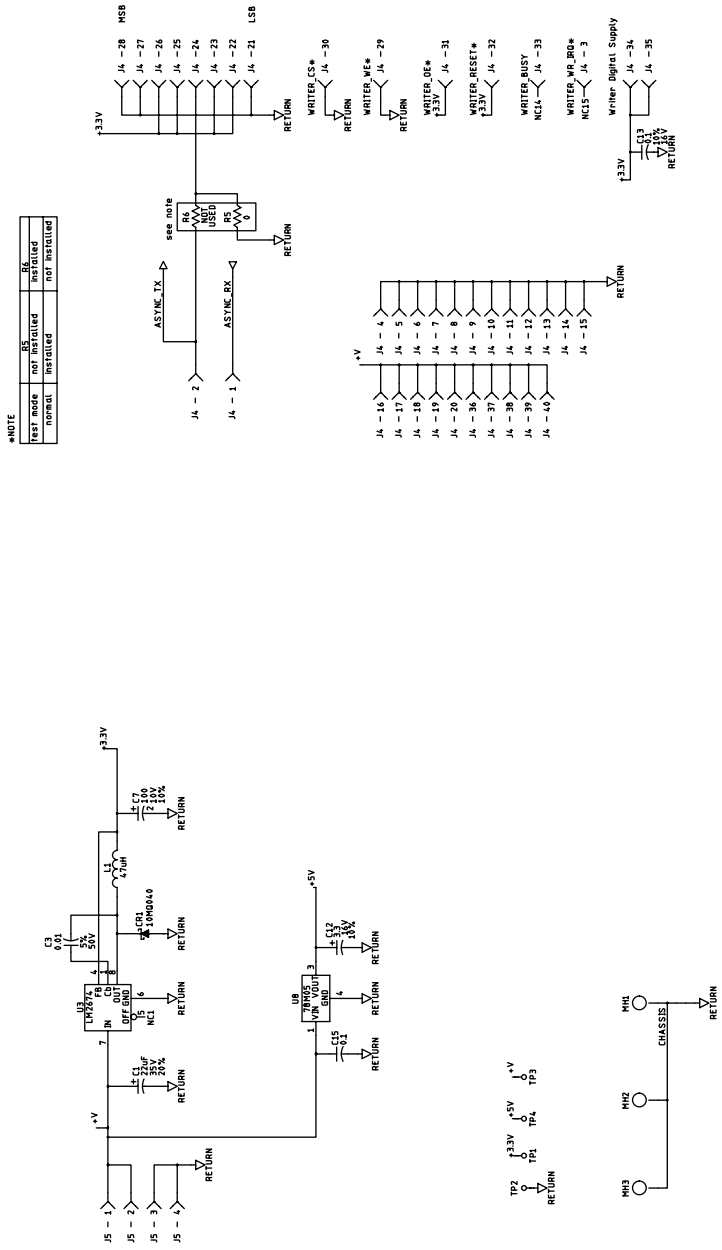


Bottom View

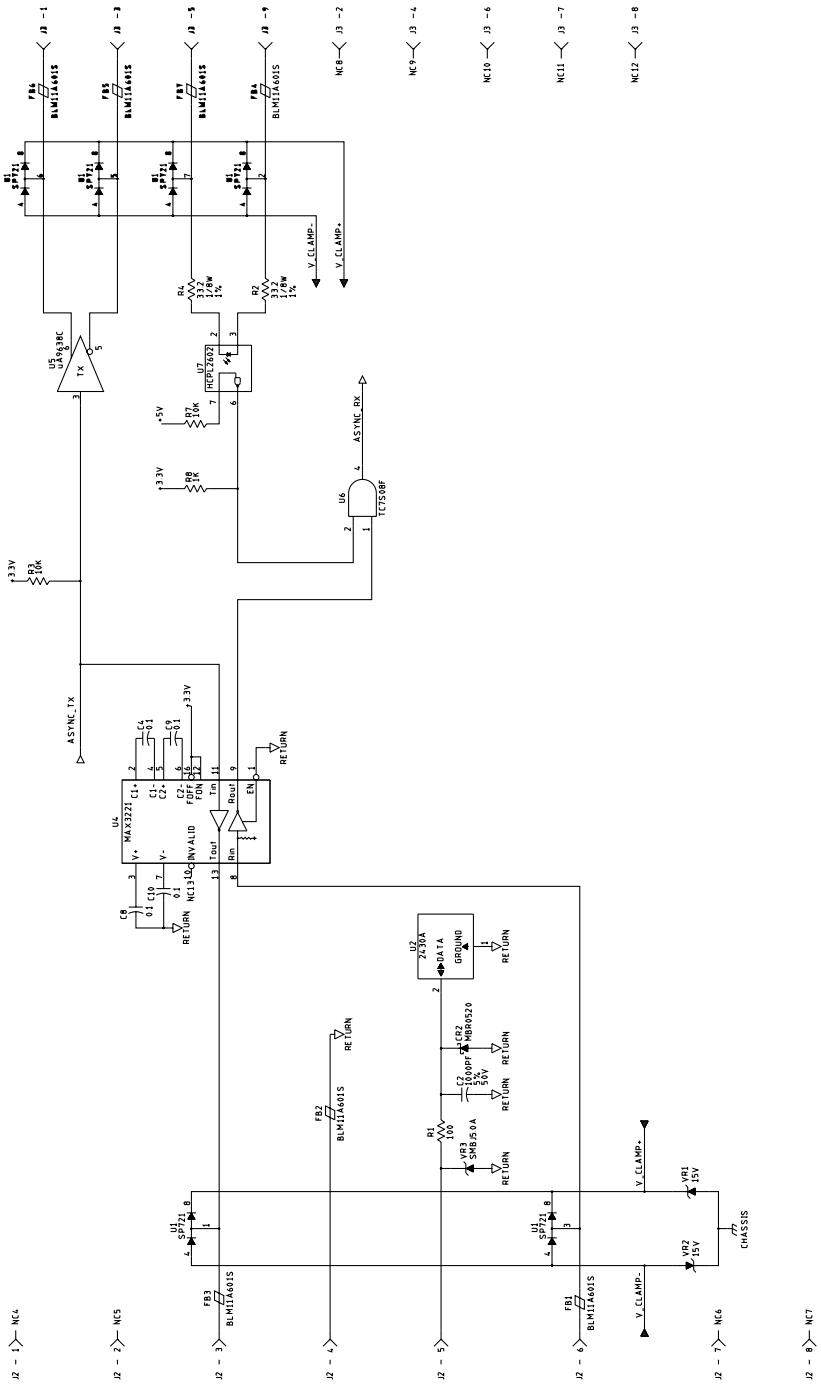


Schematic Diagram SD801390-001A

Sheet 1 of 3



Sheet 2 of 3



Sheet 3 of 3

REFD	IC		POWER		RETURN
U6	TC7S08F	5	+3.3V	3	RETURN
U4	MAX3221	15	+3.3V	14	RETURN
U5	uA9638C	1	+5V	4	RETURN
U7	HCPL2602	8	+5V	5	RETURN

REFD	VALUE	POWER	RETURN
C14	0.01	+3.3V	RETURN
C5	0.01	+3.3V	RETURN
C6	0.01	+5V	RETURN
C11	0.01	+5V	RETURN